

**CALIFORNIA DEPARTMENT OF WATER RESOURCES
OFFICE OF WATER USE EFFICIENCY**

**PROPOSITION 13 URBAN WATER CONSERVATION CAPITAL OUTLAY
GRANT APPLICATION**

WATER MAIN REPLACEMENT PROJECT



PARADISE IRRIGATION DISTRICT

Submitted by:

Paradise Irrigation District
5325 Black Olive Drive
P.O. Box 2409
Paradise, CA 95967
Prepared by:

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**Consolidated Water Use Efficiency 2002 PSP
Proposal Part One:
A. Project Information Form**

1. Applying for (select one): ☒ (a) Prop 13 Urban Water Conservation Capital Outlay Grant
☐ (b) Prop 13 Agricultural Water Conservation Capital Outlay Feasibility Study Grant
☐ (c) DWR Water Use Efficiency Project
2. Principal applicant (Organization or affiliation): Paradise Irrigation District
3. Project Title: Water Main Replacement Project
4. Person authorized to sign and submit proposal:
- | | |
|-----------------|--------------------------------------|
| Name, title | <u>Ray Auerbach, Manager</u> |
| Mailing address | <u>P.O. Box 2409, Paradise, CA</u> |
| Telephone | <u>95967-2409</u> |
| | <u>530-877-4971</u> |
| Fax. | <u>530-876-0483</u> |
| E-mail | <u>rauerbach@paradiseirrigation.</u> |
| | <u>com</u> |
5. Contact person (if different):
- | | |
|------------------|---------|
| Name, title. | <u></u> |
| Mailing address. | <u></u> |
| Telephone | <u></u> |
| Fax. | <u></u> |
| E-mail | <u></u> |
6. Funds requested (dollar amount): \$710,000
7. Applicant funds pledged (dollar amount): \$560,000
8. Total project costs (dollar amount): \$1,270,000
9. Estimated total quantifiable project benefits (dollar amount): \$2,248,000
- Percentage of benefit to be accrued by applicant: 100
- Percentage of benefit to be accrued by CALFED or others: 0

**Consolidated Water Use Efficiency 2002 PSP
Proposal Part One:
A. Project Information Form (continued)**

10. Estimated annual amount of water to be saved (acre-feet): Average of 525
- Estimated total amount of water to be saved (acre-feet): 21.000
- Over ____ years 40
- Estimated benefits to be realized in terms of water quality, instream flow, other: None
11. Duration of project (month/year to month/year): 10/02 - 10/05
12. State Assembly District where the project is to be conducted: 3
13. State Senate District where the project is to be conducted: 1
14. Congressional district(s) where the project is to be conducted: 2
15. County where the project is to be conducted: Butte
16. Date most recent Urban Water Management Plan submitted to the Department of Water Resources: 1/10/01 Revised 9/5/01
17. Type of applicant (select one):
- Prop 13 Urban Grants and Prop 13
Agricultural Feasibility Study Grants:
- ☐ (a) city
☐ (b) county
☐ (c) city and county
☐ (d) joint power authority
☒ (e) other political subdivision of the State, including public water district
☐ (f) incorporated mutual water company
- DWR WUE Projects: the above entities (a) through (f) or:
- ☒ (g) investor-owned utility
☒ (h) non-profit organization
☒ (i) tribe
☐ (j) university
☐ (k) state agency
☐ (l) federal agency

18. Project focus:

- ☐ (a) agricultural
☒ (b) urban

Consolidated Water Use Efficiency 2002 PSP

Proposal Part One:

A. Project Information Form (continued)

19. Project type (select one):
Prop 13 Urban Grant or Prop 13
Agricultural Feasibility Study Grant
capital outlay project related to:

- ☒ (a) implementation of Urban Best
Management Practices
☐ (b) implementation of Agricultural Efficient
Water Management Practices
☐ (c) implementation of Quantifiable
Objectives (include QO number(s))

- ☐ (d) other (specify)

DWR WUE Project related to:

- ☐ (e) implementation of Urban Best
Management Practices
☐ (f) implementation of Agricultural Efficient
Water Management Practices
☐ (g) implementation of Quantifiable
Objectives (include QO number(s))
☐ (h) innovative projects (initial
investigation of new technologies,
methodologies, approaches, or
institutional frameworks)
☐ (i) research or pilot projects
☐ (j) education or public information
programs
☐ (k) other (specify)

20. Do the actions in this proposal involve
physical changes in land use, or
potential future changes in land use?

- ☐ (a) yes
☒ (b) no

If yes, the applicant must complete the CALFED
PSP Land Use Checklist found at
http://calfed.water.ca.gov/environmental_docs.ht

**Consolidated Water Use Efficiency 2002 PSP
Proposal Part One
B. Signature Page**

By signing below, the official declares the following:

The truthfulness of all representations in the proposal;

The individual signing the form is authorized to submit the proposal on behalf of the applicant; and

The individual signing the form read and understood the conflict of interest and confidentiality section and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant.

R. Querbach
Signature

Ray Querbach, Manager
Name and title

3/1/02
Date

PROPOSAL PART TWO

Project Summary

The Paradise Irrigation District receives almost all of its water supply from surface runoff from the Little Butte Creek watershed. The firm yield of this surface water source is 7300 acre-feet per year, and an additional 200 acre-feet is available from one well. Current water demands are slightly greater than this firm supply, and additional water sources will be needed to supply an anticipated 20% growth in customer base. Water losses from leaking water mains have been the greatest contributor to the District's high percentage of water losses (32% in 1993). Current water losses have been reduced to approximately 16% due to a water main replacement program, but it appears that main replacement must be accelerated to bring water losses down to an acceptable level (See Figure 1). The reduction in lost water will help to defer the need to construct expensive new facilities, and will reduce the amount of additional water supply sources needed to serve new development.

The proposed Water Main Replacement Project is designed to replace approximately 17,725 feet of steel water mains constructed in the 1940's and 50's. The District maintains detailed leak records, and the proposed project will replace the mains with the worst leak record. It is anticipated that the thirteen main replacement projects will save a total of over 21,000 acre-feet of water over the 40-year assumed life of the project.

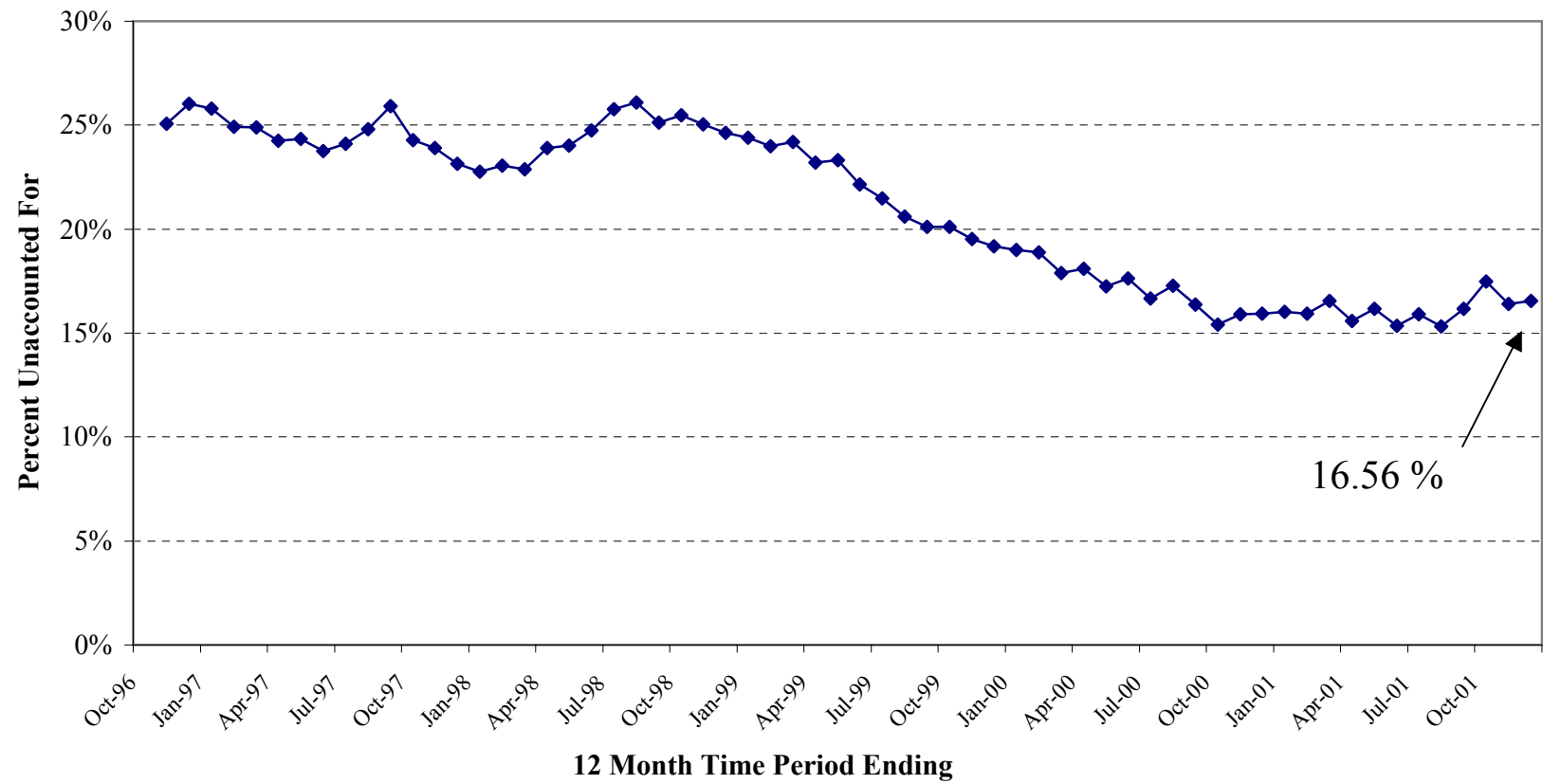
The total cost of the project is estimated to be \$1,270,000 including all labor, material, equipment, engineering, and overhead costs. The present value of project benefits is \$2,248,000, resulting in an overall benefit to cost ratio of 1.77. Thirteen separate water main replacements are proposed, and the District is proposing to complete this project over a three-year period using District forces for the construction work. The District is proposing to fund all of the labor for the design, installation and administration of this project, and is requesting grant funds for the material and equipment costs only. This proposal results in a request for approximately \$710,000 in grant funds and a \$560,000 contribution from the District.

In addition to the capital cost savings, there are additional cost savings such as cost of leak repair and the cost of producing water that is lost from the system. Another major benefit of this program is enhanced fire protection for the Town of Paradise. The mains that are proposed for replacement are generally undersized for current fire flow requirements. The new mains will provide adequate fire flows and the design fire flows and hydrant locations are coordinated with the Town of Paradise Fire Department. New fire hydrants are not included in the project costs since they do not contribute to the water savings goals. The Paradise Fire Department will fund new fire hydrants installed on the water mains.

A. Scope of Work: Relevance and Importance

1. Nature, scope and objectives of the project – the nature, scope and objectives of this project are described in the Project Summary.

Figure 1. Unaccounted for Water
12 Month Time Intervals



2. Statement of critical local, regional Bay-Delta, State or Federal water issues – The Paradise Irrigation District must augment its water supply to meet current demands in dry years and to provide supplies for future anticipated growth. Recent studies have shown that the cost of augmenting water supplies is very expensive, and it appears that reducing water lost to pipeline leaks is a cost effective method of reducing these needs.

Butte County is a major focus for CALFED because of its abundant groundwater reserves (in the valley, not on the Paradise Ridge) and critical wildlife habitat. Butte County completed a Water Inventory and Analysis in 2001 using Prop. 204 funds. That analysis identified water supply problems in the Paradise Ridge area after one drought year similar to 1977. In addition, the Butte Creek drainage area has been identified as a prime spring run salmon stream. Improved water management and water use efficiency will help maintain the improvements in that tributary to the Sacramento River. Finally, CALFED has adopted the California Urban Water Conservation Council's Best Management Practices for Urban Water Conservation. Distribution System Audits, Leak Detection and Repair is a BMP that has been shown to be cost effective throughout California.

B. Scope of Work: Technical/Scientific Merit, Feasibility, Monitoring and Assessment

1. Methods, procedures and facilities – The District maintains a detailed database of leaks on water mains. Leak information is categorized by pipeline segments, which are generally several hundred to several thousand feet in length. For this project, thirteen pipeline segments are proposed for replacement. The number of leaks in the past thirteen years for each pipeline segment and the estimated water savings for each segment over a 40-year period are shown in Appendix 1. It is assumed that the number of leaks per pipeline segment will increase at the rate of 5% per year as will the amount of water leaking from these segments (See Major Assumptions, Section D.4.a). Preliminary plans (Appendix 2) have been prepared for each pipeline segment. Since this work is proposed to be accomplished using District forces, the preliminary plans do not need a great deal of additional work before they can be issued for construction. Since the pipe sizes are 6-inch to 12-inch for all projects, materials are readily available from local suppliers. Many projects can be completed with little or no additional right-of-way acquisition, so projects can be started within weeks of receiving funding agreements.
2. Task List and Schedule - A work schedule is shown on Figure 2. Projected costs for each task are shown on Table 1. Each of the thirteen projects is a stand-alone project. Any project can be removed from the overall program without affecting other projects, but each of the thirteen projects should be

Table 1. Project Cost and Benefit Summary

Engineering: Percent of Total Construction Costs Project Administration: Percent of Total Construction Costs											5% 2%			
Project Number	Project Location	Main Size (inches)	Length (feet)	Material ¹ Cost	Labor ² Cost	Equipment ¹ Cost	Total Const. Cost	Easement ² Prep. Cost	Engineering ² Cost	Project ² Admin. Cost	Total Project Cost	Project Benefit	B/C Ratio	Total Water Saved (ac-ft)
1	Azalea Lane	6	1,900	\$34,697.82	\$36,680.00	\$28,542.50	\$99,920.32	\$19,800.00	\$4,996.02	\$1,998.41	\$126,714.74	\$140,559.43	1.11	1,326
2	Bennett Road	12	2,500	\$71,326.29	\$66,880.00	\$41,153.50	\$179,359.79	\$5,940.00	\$8,967.99	\$3,587.20	\$197,854.98	\$345,541.93	1.75	3,260
3	Butte View Terrace	8	1,350	\$33,568.24	\$31,920.00	\$22,490.00	\$87,978.24	\$0.00	\$4,398.91	\$1,759.56	\$94,136.72	\$163,986.00	1.74	1,547
4	Crestview Drive	8	1,150	\$29,766.23	\$26,880.00	\$19,179.00	\$75,825.23	\$0.00	\$3,791.26	\$1,516.50	\$81,133.00	\$210,839.14	2.60	1,989
5	Edgewood Lane	8	1,500	\$23,920.58	\$19,180.00	\$14,890.50	\$57,991.08	\$12,540.00	\$2,899.55	\$1,159.82	\$74,590.46	\$204,982.50	2.75	1,934
6	Evergreen Lane	6	650	\$13,870.25	\$16,520.00	\$12,710.00	\$43,100.25	\$0.00	\$2,155.01	\$862.01	\$46,117.27	\$81,993.00	1.78	773
7	Friendly Way	6	625	\$14,070.12	\$15,820.00	\$12,710.00	\$42,600.12	\$8,580.00	\$2,130.01	\$852.00	\$54,162.13	\$105,419.57	1.95	994
8	Molokai Drive	6	500	\$11,129.20	\$13,300.00	\$10,282.25	\$34,711.45	\$0.00	\$1,735.57	\$694.23	\$37,141.25	\$76,136.36	2.05	718
9	Peck Lane	6	1,800	\$29,852.91	\$32,060.00	\$24,833.25	\$86,746.16	\$17,820.00	\$4,337.31	\$1,734.92	\$110,638.39	\$199,125.86	1.80	1,878
10	Pentz Road	12	1,300	\$41,873.98	\$37,740.00	\$26,681.50	\$106,295.48	\$0.00	\$5,314.77	\$2,125.91	\$113,736.17	\$140,559.43	1.24	1,326
11	Stark Lane	8	1,450	\$35,524.13	\$31,920.00	\$23,772.50	\$91,216.63	\$12,540.00	\$4,560.83	\$1,824.33	\$110,141.79	\$193,269.21	1.75	1,823
12	Waggoner Road	6	1,500	\$31,794.95	\$35,140.00	\$27,864.00	\$94,798.95	\$0.00	\$4,739.95	\$1,895.98	\$101,434.87	\$210,839.14	2.08	1,989
13	Wagstaff Road	8	1,500	\$43,611.44	\$40,880.00	\$29,073.00	\$113,564.44	\$0.00	\$5,678.22	\$2,271.29	\$121,513.95	\$175,699.28	1.45	1,657
Totals			17,725	\$415,006.15	\$404,920.00	\$294,182.00	\$1,114,108.15	\$77,220.00	\$55,705.41	\$22,282.16	\$1,269,315.72	\$2,248,950.84	1.77	21,215

Notes:

¹ Proposed Grant Funded Share of Project Costs. Total Project Costs to be Grant Funded: \$709,188.15

² Proposed District Share of Project Costs. Total Project Costs to be District Funded: \$560,127.57

completed in their entirety. CEQA documentation will take place when acceptance of this proposal occurs. Sufficient time is available to complete CEQA work without affecting the project schedule.

3. Monitoring and assessment – The progress of the construction portion of the project will be monitored by determining the length of water main replaced and the cost of each pipeline segment replaced. Once the various pipeline segments have been replaced, the new segments will be incorporated into the leak database. Leak data on each pipe segment will be compared to leak data prior to replacement to determine the success of the program. The following measurements will be used to monitor the progress of the project:

During Construction:

Length of pipe installed
Cost of pipe installation

After Construction:

Number of leaks on new pipe
Estimate of water saved per pipeline segment
Cost of leak repair
District wide water losses

Data on leaks and water losses will be incorporated into the District's existing databases. The information is available in electronic format and can be provided to any interested party on request.

4. Preliminary Plans and Specifications – Preliminary Plans for the Project are provided in Appendix 2, and Specifications are provided in Appendix 3. A Certification Statement is included as Appendix 4.

C. Qualifications of the Applicants and Cooperators

1. The project will be managed by the following District employees:

Ray Auerbach, District Manager – Overall Project Management
Neil Essila, Assistant Engineer – Planning/Design/ Engineering
John Price, Field Superintendent – Construction

Resumes for these individuals are provided in Appendix 5.

2. External cooperators:

Town of Paradise Fire Department will be responsible for determining fire hydrant locations and funding the fire hydrant installations.

D. Benefits and Costs

1. Budget Breakdown and Justification – A detailed budget for each pipeline segment is provided in Table 1. All cost estimates are based on previous replacement projects completed by the District.
2. Cost Sharing – The District proposes a cost sharing method where the District will provide all labor for the design, installation and administration of the project. The District's share of the project is estimated to be \$560,000, or approximately 44% of the project budget. The District is prepared to commit funding and enter into the necessary cost sharing agreements upon notification of approval of this application.
3. Benefit Summary and Breakdown – The proposed main replacement program is expected to significantly reduce the number of leaks and the water lost due to these leaks. Quantifiable benefits include the following:

Reduction in cost of repairing leaks

Cost of water saved

Reduced amount of new capacity required to meet future water needs

A summary of these benefits for each pipeline segment is contained in Appendix 1.

4. Assessment of costs and benefits – the overall cost of replacing the thirteen pipeline segments is \$1,270,000. The benefits of the project are expected to be \$2,248,000 over a 40-year project life.

a. Major Assumptions:

Based on historical trends in leaks and unaccounted-for water it is assumed that, of the current annual 1,400 acre-feet unaccounted-for, 1,000 acre-feet of this amount is due to mainline leaks.

The District maintains an extensive database of mainline leaks by pipeline. This data is used to prioritize the mainline replacement process. Assuming that the water loss for a given mainline segment is proportional to the number of surfaced leaks, the leakage for a given main segment can be estimated as a portion of the 1,000 acre-feet total loss. The new main is assumed to eliminate all leaks from that mainline segment for the 40-year life of the project.

During the ten-year period from 1984-1993, immediately prior to instituting a mainline replacement program, the District averaged a 20 percent annual rate of increase in surfacing pipeline leaks, equating to a six-fold increase in leaks over the ten year period. For the purposes

of this analysis the number of mainline leaks per year is conservatively assumed to increase at the rate of 5 percent per year.

The cost to repair a mainline leak is based on the District's actual average cost per repair.

Similarly, the cost of mainline installation has been based on the District's experience with main installation costs.

Project benefits contain three components: savings on the incremental cost to treat additional water (chemical and pumping energy only), savings for leak repair, and the savings associated with not developing additional capacity (reservoir storage, pumping, and treatment). Capacity savings for pumping and treatment are based on the actual cost of construction for capacity in the District's existing pumping and treatment facilities. Reservoir storage capacity is based on the cost to develop additional firm yield, as determined by a feasibility study conducted by URS in 2001.

Due to the increasing number of leaks with each passing year under the no-project alternative, the water savings under the project alternative also increase. These increased water savings create an incremental increase in capacity savings that have then been assigned a current value in computing the total project benefits over project life.

- b. All costs and benefits in Appendix 1 are converted to present value
- c. A six percent discount rate has been used
- d. All monetary benefits are expected to accrue to the District. To the extent water is saved, this water will not be diverted from Little Butte Creek, and will be available for other uses downstream.
- e. This Proposition 13 Grant Project is locally cost effective as shown by the overall benefit/cost ratio of 1.77.

E. Outreach, Community Involvement and Acceptance

The District's water main replacement program is well understood by community residents. Close coordination with the Town of Paradise Fire Department is an integral part of the program to assure that fire protection concerns are addressed. In addition, the District is working closely with the Butte County Department of Water and Resource Conservation and the Del Oro Water Company to investigate solutions to the water supply problems on the Paradise Ridge. A memorandum of Understanding between these three agencies requires several public meetings each year to inform the public on the progress of this joint effort. See Appendix 6 for attached letters of support for this grant application

Appendix 1. Benefit / Cost Ratio Analyses

Appendix 1. Table 1. Benefit / Cost Ratio Analysis - Azalea Lane Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	24
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.04%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1900
		Project cost	\$126,714.74
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$140,559.43
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.109

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	1.85	\$753.23	10.37	\$346.31	\$1,099.54	\$1,099.54	10.37	\$39,967.77	\$39,967.77
1	1.94	\$790.89	10.89	\$363.62	\$1,154.52	\$1,089.17	0.52	\$1,998.39	\$1,885.27
2	2.04	\$830.44	11.43	\$381.81	\$1,212.24	\$1,078.89	0.54	\$2,098.31	\$1,867.49
3	2.14	\$871.96	12.01	\$400.90	\$1,272.86	\$1,068.71	0.57	\$2,203.22	\$1,849.87
4	2.24	\$915.56	12.61	\$420.94	\$1,336.50	\$1,058.63	0.60	\$2,313.38	\$1,832.42
5	2.36	\$961.33	13.24	\$441.99	\$1,403.32	\$1,048.64	0.63	\$2,429.05	\$1,815.13
6	2.47	\$1,009.40	13.90	\$464.09	\$1,473.49	\$1,038.75	0.66	\$2,550.51	\$1,798.01
7	2.60	\$1,059.87	14.59	\$487.29	\$1,547.16	\$1,028.95	0.69	\$2,678.03	\$1,781.04
8	2.73	\$1,112.86	15.32	\$511.66	\$1,624.52	\$1,019.24	0.73	\$2,811.93	\$1,764.24
9	2.86	\$1,168.51	16.09	\$537.24	\$1,705.75	\$1,009.63	0.77	\$2,952.53	\$1,747.60
10	3.01	\$1,226.93	16.89	\$564.10	\$1,791.04	\$1,000.10	0.80	\$3,100.16	\$1,731.11
11	3.16	\$1,288.28	17.74	\$592.31	\$1,880.59	\$990.67	0.84	\$3,255.16	\$1,714.78
12	3.32	\$1,352.69	18.63	\$621.92	\$1,974.62	\$981.32	0.89	\$3,417.92	\$1,698.60
13	3.48	\$1,420.33	19.56	\$653.02	\$2,073.35	\$972.07	0.93	\$3,588.82	\$1,682.58
14	3.66	\$1,491.35	20.54	\$685.67	\$2,177.01	\$962.90	0.98	\$3,768.26	\$1,666.70
15	3.84	\$1,565.91	21.56	\$719.95	\$2,285.87	\$953.81	1.03	\$3,956.67	\$1,650.98
16	4.03	\$1,644.21	22.64	\$755.95	\$2,400.16	\$944.81	1.08	\$4,154.51	\$1,635.41
17	4.23	\$1,726.42	23.77	\$793.75	\$2,520.17	\$935.90	1.13	\$4,362.23	\$1,619.98
18	4.44	\$1,812.74	24.96	\$833.43	\$2,646.17	\$927.07	1.19	\$4,580.34	\$1,604.69
19	4.67	\$1,903.38	26.21	\$875.11	\$2,778.48	\$918.32	1.25	\$4,809.36	\$1,589.56
20	4.90	\$1,998.55	27.52	\$918.86	\$2,917.41	\$909.66	1.31	\$5,049.83	\$1,574.56
21	5.14	\$2,098.47	28.90	\$964.81	\$3,063.28	\$901.08	1.38	\$5,302.32	\$1,559.71
22	5.40	\$2,203.40	30.34	\$1,013.05	\$3,216.44	\$892.58	1.44	\$5,567.44	\$1,544.99
23	5.67	\$2,313.57	31.86	\$1,063.70	\$3,377.26	\$884.16	1.52	\$5,845.81	\$1,530.42
24	5.95	\$2,429.24	33.45	\$1,116.88	\$3,546.13	\$875.82	1.59	\$6,138.10	\$1,515.98
25	6.25	\$2,550.71	35.12	\$1,172.73	\$3,723.43	\$867.55	1.67	\$6,445.00	\$1,501.68
26	6.56	\$2,678.24	36.88	\$1,231.36	\$3,909.61	\$859.37	1.76	\$6,767.25	\$1,487.51
27	6.89	\$2,812.15	38.72	\$1,292.93	\$4,105.09	\$851.26	1.84	\$7,105.62	\$1,473.48
28	7.24	\$2,952.76	40.66	\$1,357.58	\$4,310.34	\$843.23	1.94	\$7,460.90	\$1,459.58
29	7.60	\$3,100.40	42.69	\$1,425.46	\$4,525.86	\$835.28	2.03	\$7,833.94	\$1,445.81
30	7.98	\$3,255.42	44.83	\$1,496.73	\$4,752.15	\$827.40	2.13	\$8,225.64	\$1,432.17
31	8.38	\$3,418.19	47.07	\$1,571.57	\$4,989.76	\$819.59	2.24	\$8,636.92	\$1,418.66
32	8.80	\$3,589.10	49.42	\$1,650.14	\$5,239.24	\$811.86	2.35	\$9,068.77	\$1,405.27
33	9.24	\$3,768.56	51.89	\$1,732.65	\$5,501.21	\$804.20	2.47	\$9,522.20	\$1,392.02
34	9.70	\$3,956.98	54.49	\$1,819.28	\$5,776.27	\$796.61	2.59	\$9,998.31	\$1,378.88
35	10.18	\$4,154.83	57.21	\$1,910.25	\$6,065.08	\$789.10	2.72	\$10,498.23	\$1,365.87
36	10.69	\$4,362.57	60.07	\$2,005.76	\$6,368.33	\$781.65	2.86	\$11,023.14	\$1,352.99
37	11.23	\$4,580.70	63.07	\$2,106.05	\$6,686.75	\$774.28	3.00	\$11,574.30	\$1,340.22
38	11.79	\$4,809.74	66.23	\$2,211.35	\$7,021.09	\$766.98	3.15	\$12,153.01	\$1,327.58
39	12.38	\$5,050.22	69.54	\$2,321.92	\$7,372.14	\$759.74	3.31	\$12,760.66	\$1,315.06
40	13.00	\$5,302.74	73.02	\$2,438.01	\$7,740.75	\$752.57	3.48	\$13,398.70	\$1,302.65
Totals			1,326	acre-feet		\$37,531.13			\$103,028.30

Appendix 1. Table 2. Benefit / Cost Ratio Analysis - Bennett Road Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	59
Escalation Rate	0.0%	Percent of System Wide Total Leaks	2.55%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	2500
		Project cost	\$197,854.98
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$345,541.93
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.746

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	4.54	\$1,851.69	25.50	\$851.34	\$2,703.04	\$2,703.04	25.50	\$98,254.10	\$98,254.10
1	4.77	\$1,944.28	26.77	\$893.91	\$2,838.19	\$2,677.54	1.27	\$4,912.71	\$4,634.63
2	5.00	\$2,041.49	28.11	\$938.61	\$2,980.10	\$2,652.28	1.34	\$5,158.34	\$4,590.90
3	5.25	\$2,143.57	29.52	\$985.54	\$3,129.10	\$2,627.25	1.41	\$5,416.26	\$4,547.59
4	5.52	\$2,250.74	30.99	\$1,034.81	\$3,285.56	\$2,602.47	1.48	\$5,687.07	\$4,504.69
5	5.79	\$2,363.28	32.54	\$1,086.55	\$3,449.84	\$2,577.92	1.55	\$5,971.42	\$4,462.20
6	6.08	\$2,481.44	34.17	\$1,140.88	\$3,622.33	\$2,553.60	1.63	\$6,270.00	\$4,420.10
7	6.39	\$2,605.52	35.88	\$1,197.93	\$3,803.44	\$2,529.51	1.71	\$6,583.49	\$4,378.40
8	6.71	\$2,735.79	37.67	\$1,257.82	\$3,993.62	\$2,505.64	1.79	\$6,912.67	\$4,337.09
9	7.04	\$2,872.58	39.55	\$1,320.71	\$4,193.30	\$2,482.01	1.88	\$7,258.30	\$4,296.18
10	7.39	\$3,016.21	41.53	\$1,386.75	\$4,402.96	\$2,458.59	1.98	\$7,621.22	\$4,255.65
11	7.76	\$3,167.02	43.61	\$1,456.09	\$4,623.11	\$2,435.40	2.08	\$8,002.28	\$4,215.50
12	8.15	\$3,325.37	45.79	\$1,528.89	\$4,854.26	\$2,412.42	2.18	\$8,402.39	\$4,175.73
13	8.56	\$3,491.64	48.08	\$1,605.34	\$5,096.98	\$2,389.66	2.29	\$8,822.51	\$4,136.34
14	8.99	\$3,666.22	50.48	\$1,685.60	\$5,351.83	\$2,367.12	2.40	\$9,263.64	\$4,097.32
15	9.44	\$3,849.54	53.01	\$1,769.88	\$5,619.42	\$2,344.79	2.52	\$9,726.82	\$4,058.66
16	9.91	\$4,042.01	55.66	\$1,858.38	\$5,900.39	\$2,322.67	2.65	\$10,213.16	\$4,020.37
17	10.40	\$4,244.11	58.44	\$1,951.30	\$6,195.41	\$2,300.75	2.78	\$10,723.82	\$3,982.44
18	10.92	\$4,456.32	61.36	\$2,048.86	\$6,505.18	\$2,279.05	2.92	\$11,260.01	\$3,944.87
19	11.47	\$4,679.13	64.43	\$2,151.30	\$6,830.44	\$2,257.55	3.07	\$11,823.01	\$3,907.66
20	12.04	\$4,913.09	67.65	\$2,258.87	\$7,171.96	\$2,236.25	3.22	\$12,414.16	\$3,870.79
21	12.64	\$5,158.75	71.03	\$2,371.81	\$7,530.56	\$2,215.15	3.38	\$13,034.87	\$3,834.28
22	13.28	\$5,416.68	74.59	\$2,490.40	\$7,907.09	\$2,194.26	3.55	\$13,686.61	\$3,798.10
23	13.94	\$5,687.52	78.31	\$2,614.92	\$8,302.44	\$2,173.56	3.73	\$14,370.94	\$3,762.27
24	14.64	\$5,971.89	82.23	\$2,745.67	\$8,717.56	\$2,153.05	3.92	\$15,089.49	\$3,726.78
25	15.37	\$6,270.49	86.34	\$2,882.95	\$9,153.44	\$2,132.74	4.11	\$15,843.97	\$3,691.62
26	16.14	\$6,584.01	90.66	\$3,027.10	\$9,611.11	\$2,112.62	4.32	\$16,636.16	\$3,656.80
27	16.94	\$6,913.21	95.19	\$3,178.46	\$10,091.67	\$2,092.69	4.53	\$17,467.97	\$3,622.30
28	17.79	\$7,258.87	99.95	\$3,337.38	\$10,596.25	\$2,072.95	4.76	\$18,341.37	\$3,588.12
29	18.68	\$7,621.82	104.95	\$3,504.25	\$11,126.06	\$2,053.39	5.00	\$19,258.44	\$3,554.27
30	19.61	\$8,002.91	110.20	\$3,679.46	\$11,682.37	\$2,034.02	5.25	\$20,221.36	\$3,520.74
31	20.60	\$8,403.05	115.71	\$3,863.43	\$12,266.49	\$2,014.83	5.51	\$21,232.43	\$3,487.53
32	21.63	\$8,823.21	121.49	\$4,056.60	\$12,879.81	\$1,995.82	5.79	\$22,294.05	\$3,454.63
33	22.71	\$9,264.37	127.57	\$4,259.43	\$13,523.80	\$1,976.99	6.07	\$23,408.75	\$3,422.04
34	23.84	\$9,727.58	133.94	\$4,472.41	\$14,199.99	\$1,958.34	6.38	\$24,579.19	\$3,389.75
35	25.03	\$10,213.96	140.64	\$4,696.03	\$14,909.99	\$1,939.87	6.70	\$25,808.15	\$3,357.78
36	26.29	\$10,724.66	147.67	\$4,930.83	\$15,655.49	\$1,921.57	7.03	\$27,098.56	\$3,326.10
37	27.60	\$11,260.89	155.06	\$5,177.37	\$16,438.26	\$1,903.44	7.38	\$28,453.49	\$3,294.72
38	28.98	\$11,823.94	162.81	\$5,436.24	\$17,260.18	\$1,885.48	7.75	\$29,876.16	\$3,263.64
39	30.43	\$12,415.14	170.95	\$5,708.05	\$18,123.19	\$1,867.69	8.14	\$31,369.97	\$3,232.85
40	31.95	\$13,035.89	179.50	\$5,993.45	\$19,029.35	\$1,850.07	8.55	\$32,938.47	\$3,202.35
Totals			3,260	acre-feet		\$92,264.02			\$253,277.91

Appendix 1. Table 3. Benefit / Cost Ratio Analysis - Butte View Terrace Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	28
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.21%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1350
		Project cost	\$94,136.72
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$163,986.00
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.742

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.15	\$878.77	12.10	\$404.03	\$1,282.80	\$1,282.80	12.10	\$46,629.07	\$46,629.07
1	2.26	\$922.71	12.71	\$424.23	\$1,346.94	\$1,270.70	0.61	\$2,331.45	\$2,199.48
2	2.37	\$968.84	13.34	\$445.44	\$1,414.28	\$1,258.71	0.64	\$2,448.03	\$2,178.73
3	2.49	\$1,017.29	14.01	\$467.71	\$1,485.00	\$1,246.83	0.67	\$2,570.43	\$2,158.18
4	2.62	\$1,068.15	14.71	\$491.10	\$1,559.25	\$1,235.07	0.70	\$2,698.95	\$2,137.82
5	2.75	\$1,121.56	15.44	\$515.65	\$1,637.21	\$1,223.42	0.74	\$2,833.90	\$2,117.65
6	2.89	\$1,177.63	16.22	\$541.44	\$1,719.07	\$1,211.88	0.77	\$2,975.59	\$2,097.67
7	3.03	\$1,236.52	17.03	\$568.51	\$1,805.02	\$1,200.44	0.81	\$3,124.37	\$2,077.88
8	3.18	\$1,298.34	17.88	\$596.93	\$1,895.28	\$1,189.12	0.85	\$3,280.59	\$2,058.28
9	3.34	\$1,363.26	18.77	\$626.78	\$1,990.04	\$1,177.90	0.89	\$3,444.62	\$2,038.86
10	3.51	\$1,431.42	19.71	\$658.12	\$2,089.54	\$1,166.79	0.94	\$3,616.85	\$2,019.63
11	3.68	\$1,502.99	20.70	\$691.02	\$2,194.02	\$1,155.78	0.99	\$3,797.69	\$2,000.58
12	3.87	\$1,578.14	21.73	\$725.58	\$2,303.72	\$1,144.88	1.03	\$3,987.58	\$1,981.70
13	4.06	\$1,657.05	22.82	\$761.85	\$2,418.90	\$1,134.08	1.09	\$4,186.96	\$1,963.01
14	4.26	\$1,739.90	23.96	\$799.95	\$2,539.85	\$1,123.38	1.14	\$4,396.30	\$1,944.49
15	4.48	\$1,826.90	25.16	\$839.94	\$2,666.84	\$1,112.78	1.20	\$4,616.12	\$1,926.14
16	4.70	\$1,918.24	26.41	\$881.94	\$2,800.18	\$1,102.28	1.26	\$4,846.92	\$1,907.97
17	4.94	\$2,014.16	27.73	\$926.04	\$2,940.19	\$1,091.88	1.32	\$5,089.27	\$1,889.97
18	5.18	\$2,114.86	29.12	\$972.34	\$3,087.20	\$1,081.58	1.39	\$5,343.73	\$1,872.14
19	5.44	\$2,220.61	30.58	\$1,020.96	\$3,241.56	\$1,071.38	1.46	\$5,610.92	\$1,854.48
20	5.71	\$2,331.64	32.11	\$1,072.01	\$3,403.64	\$1,061.27	1.53	\$5,891.47	\$1,836.99
21	6.00	\$2,448.22	33.71	\$1,125.61	\$3,573.82	\$1,051.26	1.61	\$6,186.04	\$1,819.66
22	6.30	\$2,570.63	35.40	\$1,181.89	\$3,752.52	\$1,041.34	1.69	\$6,495.34	\$1,802.49
23	6.62	\$2,699.16	37.17	\$1,240.98	\$3,940.14	\$1,031.52	1.77	\$6,820.11	\$1,785.49
24	6.95	\$2,834.12	39.02	\$1,303.03	\$4,137.15	\$1,021.79	1.86	\$7,161.11	\$1,768.64
25	7.29	\$2,975.82	40.98	\$1,368.18	\$4,344.01	\$1,012.15	1.95	\$7,519.17	\$1,751.96
26	7.66	\$3,124.62	43.02	\$1,436.59	\$4,561.21	\$1,002.60	2.05	\$7,895.13	\$1,735.43
27	8.04	\$3,280.85	45.18	\$1,508.42	\$4,789.27	\$993.14	2.15	\$8,289.88	\$1,719.06
28	8.44	\$3,444.89	47.43	\$1,583.84	\$5,028.73	\$983.77	2.26	\$8,704.38	\$1,702.84
29	8.87	\$3,617.13	49.81	\$1,663.03	\$5,280.17	\$974.49	2.37	\$9,139.60	\$1,686.77
30	9.31	\$3,797.99	52.30	\$1,746.18	\$5,544.17	\$965.30	2.49	\$9,596.58	\$1,670.86
31	9.77	\$3,987.89	54.91	\$1,833.49	\$5,821.38	\$956.19	2.61	\$10,076.41	\$1,655.10
32	10.26	\$4,187.28	57.66	\$1,925.17	\$6,112.45	\$947.17	2.75	\$10,580.23	\$1,639.48
33	10.78	\$4,396.65	60.54	\$2,021.43	\$6,418.07	\$938.23	2.88	\$11,109.24	\$1,624.02
34	11.31	\$4,616.48	63.57	\$2,122.50	\$6,738.98	\$929.38	3.03	\$11,664.70	\$1,608.70
35	11.88	\$4,847.30	66.75	\$2,228.62	\$7,075.93	\$920.62	3.18	\$12,247.94	\$1,593.52
36	12.47	\$5,089.67	70.08	\$2,340.05	\$7,429.72	\$911.93	3.34	\$12,860.33	\$1,578.49
37	13.10	\$5,344.15	73.59	\$2,457.06	\$7,801.21	\$903.33	3.50	\$13,503.35	\$1,563.60
38	13.75	\$5,611.36	77.27	\$2,579.91	\$8,191.27	\$894.80	3.68	\$14,178.52	\$1,548.84
39	14.44	\$5,891.93	81.13	\$2,708.90	\$8,600.83	\$886.36	3.86	\$14,887.44	\$1,534.23
40	15.16	\$6,186.53	85.19	\$2,844.35	\$9,030.88	\$878.00	4.06	\$15,631.81	\$1,519.76
Totals			1,547	acre-feet		\$43,786.31			\$120,199.68

Appendix 1. Table 4. Benefit / Cost Ratio Analysis - Crestview Drive Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	36
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.56%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1150
		Project cost	\$81,133.00
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$210,839.14
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	2.599

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.77	\$1,129.85	15.56	\$519.46	\$1,649.31	\$1,649.31	15.56	\$59,951.66	\$59,951.66
1	2.91	\$1,186.34	16.34	\$545.44	\$1,731.78	\$1,633.75	0.78	\$2,997.58	\$2,827.91
2	3.05	\$1,245.66	17.15	\$572.71	\$1,818.36	\$1,618.34	0.82	\$3,147.46	\$2,801.23
3	3.21	\$1,307.94	18.01	\$601.34	\$1,909.28	\$1,603.07	0.86	\$3,304.84	\$2,774.80
4	3.37	\$1,373.34	18.91	\$631.41	\$2,004.75	\$1,587.95	0.90	\$3,470.08	\$2,748.63
5	3.53	\$1,442.00	19.86	\$662.98	\$2,104.98	\$1,572.97	0.95	\$3,643.58	\$2,722.70
6	3.71	\$1,514.10	20.85	\$696.13	\$2,210.23	\$1,558.13	0.99	\$3,825.76	\$2,697.01
7	3.90	\$1,589.81	21.89	\$730.94	\$2,320.75	\$1,543.43	1.04	\$4,017.05	\$2,671.57
8	4.09	\$1,669.30	22.99	\$767.49	\$2,436.78	\$1,528.87	1.09	\$4,217.90	\$2,646.36
9	4.30	\$1,752.76	24.13	\$805.86	\$2,558.62	\$1,514.44	1.15	\$4,428.80	\$2,621.40
10	4.51	\$1,840.40	25.34	\$846.15	\$2,686.55	\$1,500.16	1.21	\$4,650.23	\$2,596.67
11	4.74	\$1,932.42	26.61	\$888.46	\$2,820.88	\$1,486.00	1.27	\$4,882.75	\$2,572.17
12	4.97	\$2,029.04	27.94	\$932.88	\$2,961.92	\$1,471.99	1.33	\$5,126.88	\$2,547.90
13	5.22	\$2,130.49	29.34	\$979.53	\$3,110.02	\$1,458.10	1.40	\$5,383.23	\$2,523.87
14	5.48	\$2,237.02	30.80	\$1,028.50	\$3,265.52	\$1,444.34	1.47	\$5,652.39	\$2,500.06
15	5.76	\$2,348.87	32.34	\$1,079.93	\$3,428.80	\$1,430.72	1.54	\$5,935.01	\$2,476.47
16	6.04	\$2,466.31	33.96	\$1,133.93	\$3,600.24	\$1,417.22	1.62	\$6,231.76	\$2,453.11
17	6.35	\$2,589.63	35.66	\$1,190.62	\$3,780.25	\$1,403.85	1.70	\$6,543.35	\$2,429.97
18	6.66	\$2,719.11	37.44	\$1,250.15	\$3,969.26	\$1,390.61	1.78	\$6,870.51	\$2,407.04
19	7.00	\$2,855.06	39.31	\$1,312.66	\$4,167.72	\$1,377.49	1.87	\$7,214.04	\$2,384.33
20	7.35	\$2,997.82	41.28	\$1,378.29	\$4,376.11	\$1,364.49	1.97	\$7,574.74	\$2,361.84
21	7.71	\$3,147.71	43.34	\$1,447.21	\$4,594.92	\$1,351.62	2.06	\$7,953.48	\$2,339.56
22	8.10	\$3,305.09	45.51	\$1,519.57	\$4,824.66	\$1,338.87	2.17	\$8,351.15	\$2,317.49
23	8.51	\$3,470.35	47.79	\$1,595.55	\$5,065.90	\$1,326.24	2.28	\$8,768.71	\$2,295.62
24	8.93	\$3,643.87	50.17	\$1,675.32	\$5,319.19	\$1,313.73	2.39	\$9,207.15	\$2,273.97
25	9.38	\$3,826.06	52.68	\$1,759.09	\$5,585.15	\$1,301.33	2.51	\$9,667.50	\$2,252.52
26	9.85	\$4,017.36	55.32	\$1,847.04	\$5,864.41	\$1,289.06	2.63	\$10,150.88	\$2,231.27
27	10.34	\$4,218.23	58.08	\$1,939.40	\$6,157.63	\$1,276.89	2.77	\$10,658.42	\$2,210.22
28	10.86	\$4,429.14	60.99	\$2,036.37	\$6,465.51	\$1,264.85	2.90	\$11,191.34	\$2,189.36
29	11.40	\$4,650.60	64.04	\$2,138.18	\$6,788.78	\$1,252.92	3.05	\$11,750.91	\$2,168.71
30	11.97	\$4,883.13	67.24	\$2,245.09	\$7,128.22	\$1,241.10	3.20	\$12,338.46	\$2,148.25
31	12.57	\$5,127.29	70.60	\$2,357.35	\$7,484.64	\$1,229.39	3.36	\$12,955.38	\$2,127.98
32	13.20	\$5,383.65	74.13	\$2,475.22	\$7,858.87	\$1,217.79	3.53	\$13,603.15	\$2,107.91
33	13.85	\$5,652.83	77.84	\$2,598.98	\$8,251.81	\$1,206.30	3.71	\$14,283.31	\$2,088.02
34	14.55	\$5,935.47	81.73	\$2,728.93	\$8,664.40	\$1,194.92	3.89	\$14,997.47	\$2,068.32
35	15.28	\$6,232.25	85.82	\$2,865.37	\$9,097.62	\$1,183.65	4.09	\$15,747.35	\$2,048.81
36	16.04	\$6,543.86	90.11	\$3,008.64	\$9,552.50	\$1,172.48	4.29	\$16,534.71	\$2,029.48
37	16.84	\$6,871.05	94.61	\$3,159.07	\$10,030.13	\$1,161.42	4.51	\$17,361.45	\$2,010.34
38	17.68	\$7,214.61	99.34	\$3,317.03	\$10,531.63	\$1,150.46	4.73	\$18,229.52	\$1,991.37
39	18.57	\$7,575.34	104.31	\$3,482.88	\$11,058.22	\$1,139.61	4.97	\$19,141.00	\$1,972.59
40	19.50	\$7,954.10	109.52	\$3,657.02	\$11,611.13	\$1,128.86	5.22	\$20,098.05	\$1,953.98
Totals			1,989	acre-feet		\$56,296.69			\$154,542.45

Appendix 1. Table 5. Benefit / Cost Ratio Analysis - Edgewood Lane Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	35
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.51%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1500
		Project cost	\$74,590.46
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$204,982.50
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	2.748

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.69	\$1,098.46	15.13	\$505.03	\$1,603.50	\$1,603.50	15.13	\$58,286.33	\$58,286.33
1	2.83	\$1,153.38	15.88	\$530.29	\$1,683.67	\$1,588.37	0.76	\$2,914.32	\$2,749.36
2	2.97	\$1,211.05	16.68	\$556.80	\$1,767.85	\$1,573.38	0.79	\$3,060.03	\$2,723.42
3	3.12	\$1,271.61	17.51	\$584.64	\$1,856.25	\$1,558.54	0.83	\$3,213.03	\$2,697.73
4	3.27	\$1,335.19	18.38	\$613.87	\$1,949.06	\$1,543.84	0.88	\$3,373.69	\$2,672.28
5	3.44	\$1,401.95	19.30	\$644.57	\$2,046.51	\$1,529.27	0.92	\$3,542.37	\$2,647.07
6	3.61	\$1,472.04	20.27	\$676.79	\$2,148.84	\$1,514.85	0.97	\$3,719.49	\$2,622.09
7	3.79	\$1,545.65	21.28	\$710.63	\$2,256.28	\$1,500.56	1.01	\$3,905.46	\$2,597.36
8	3.98	\$1,622.93	22.35	\$746.17	\$2,369.09	\$1,486.40	1.06	\$4,100.74	\$2,572.85
9	4.18	\$1,704.07	23.46	\$783.47	\$2,487.55	\$1,472.38	1.12	\$4,305.77	\$2,548.58
10	4.39	\$1,789.28	24.64	\$822.65	\$2,611.93	\$1,458.49	1.17	\$4,521.06	\$2,524.54
11	4.60	\$1,878.74	25.87	\$863.78	\$2,742.52	\$1,444.73	1.23	\$4,747.11	\$2,500.72
12	4.83	\$1,972.68	27.16	\$906.97	\$2,879.65	\$1,431.10	1.29	\$4,984.47	\$2,477.13
13	5.08	\$2,071.31	28.52	\$952.32	\$3,023.63	\$1,417.60	1.36	\$5,233.69	\$2,453.76
14	5.33	\$2,174.88	29.95	\$999.93	\$3,174.81	\$1,404.22	1.43	\$5,495.38	\$2,430.61
15	5.60	\$2,283.62	31.44	\$1,049.93	\$3,333.55	\$1,390.98	1.50	\$5,770.15	\$2,407.68
16	5.88	\$2,397.80	33.02	\$1,102.43	\$3,500.23	\$1,377.85	1.57	\$6,058.66	\$2,384.97
17	6.17	\$2,517.69	34.67	\$1,157.55	\$3,675.24	\$1,364.85	1.65	\$6,361.59	\$2,362.47
18	6.48	\$2,643.58	36.40	\$1,215.43	\$3,859.00	\$1,351.98	1.73	\$6,679.67	\$2,340.18
19	6.80	\$2,775.76	38.22	\$1,276.20	\$4,051.95	\$1,339.22	1.82	\$7,013.65	\$2,318.10
20	7.14	\$2,914.55	40.13	\$1,340.01	\$4,254.55	\$1,326.59	1.91	\$7,364.33	\$2,296.23
21	7.50	\$3,060.27	42.14	\$1,407.01	\$4,467.28	\$1,314.07	2.01	\$7,732.55	\$2,274.57
22	7.88	\$3,213.29	44.25	\$1,477.36	\$4,690.64	\$1,301.68	2.11	\$8,119.18	\$2,253.11
23	8.27	\$3,373.95	46.46	\$1,551.23	\$4,925.18	\$1,289.40	2.21	\$8,525.14	\$2,231.86
24	8.68	\$3,542.65	48.78	\$1,628.79	\$5,171.44	\$1,277.23	2.32	\$8,951.39	\$2,210.80
25	9.12	\$3,719.78	51.22	\$1,710.23	\$5,430.01	\$1,265.18	2.44	\$9,398.96	\$2,189.95
26	9.57	\$3,905.77	53.78	\$1,795.74	\$5,701.51	\$1,253.25	2.56	\$9,868.91	\$2,169.29
27	10.05	\$4,101.06	56.47	\$1,885.52	\$5,986.58	\$1,241.43	2.69	\$10,362.36	\$2,148.82
28	10.55	\$4,306.11	59.29	\$1,979.80	\$6,285.91	\$1,229.71	2.82	\$10,880.47	\$2,128.55
29	11.08	\$4,521.42	62.26	\$2,078.79	\$6,600.21	\$1,218.11	2.96	\$11,424.50	\$2,108.47
30	11.64	\$4,747.49	65.37	\$2,182.73	\$6,930.22	\$1,206.62	3.11	\$11,995.72	\$2,088.58
31	12.22	\$4,984.86	68.64	\$2,291.87	\$7,276.73	\$1,195.24	3.27	\$12,595.51	\$2,068.87
32	12.83	\$5,234.10	72.07	\$2,406.46	\$7,640.57	\$1,183.96	3.43	\$13,225.28	\$2,049.36
33	13.47	\$5,495.81	75.67	\$2,526.78	\$8,022.59	\$1,172.79	3.60	\$13,886.55	\$2,030.02
34	14.14	\$5,770.60	79.46	\$2,653.12	\$8,423.72	\$1,161.73	3.78	\$14,580.88	\$2,010.87
35	14.85	\$6,059.13	83.43	\$2,785.78	\$8,844.91	\$1,150.77	3.97	\$15,309.92	\$1,991.90
36	15.59	\$6,362.09	87.60	\$2,925.07	\$9,287.15	\$1,139.91	4.17	\$16,075.42	\$1,973.11
37	16.37	\$6,680.19	91.98	\$3,071.32	\$9,751.51	\$1,129.16	4.38	\$16,879.19	\$1,954.49
38	17.19	\$7,014.20	96.58	\$3,224.89	\$10,239.09	\$1,118.51	4.60	\$17,723.15	\$1,936.06
39	18.05	\$7,364.91	101.41	\$3,386.13	\$10,751.04	\$1,107.95	4.83	\$18,609.30	\$1,917.79
40	18.95	\$7,733.16	106.48	\$3,555.44	\$11,288.59	\$1,097.50	5.07	\$19,539.77	\$1,899.70
Totals			1,934	acre-feet		\$54,732.89			\$150,249.61

Appendix 1. Table 6. Benefit / Cost Ratio Analysis - Evergreen Lane Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	14
Escalation Rate	0.0%	Percent of System Wide Total Leaks	0.61%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	650
		Project cost	\$46,117.27
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$81,993.00
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.778

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	1.08	\$439.38	6.05	\$202.01	\$641.40	\$641.40	6.05	\$23,314.53	\$23,314.53
1	1.13	\$461.35	6.35	\$212.11	\$673.47	\$635.35	0.30	\$1,165.73	\$1,099.74
2	1.19	\$484.42	6.67	\$222.72	\$707.14	\$629.35	0.32	\$1,224.01	\$1,089.37
3	1.25	\$508.64	7.00	\$233.86	\$742.50	\$623.42	0.33	\$1,285.21	\$1,079.09
4	1.31	\$534.07	7.35	\$245.55	\$779.62	\$617.54	0.35	\$1,349.47	\$1,068.91
5	1.37	\$560.78	7.72	\$257.83	\$818.61	\$611.71	0.37	\$1,416.95	\$1,058.83
6	1.44	\$588.82	8.11	\$270.72	\$859.54	\$605.94	0.39	\$1,487.80	\$1,048.84
7	1.52	\$618.26	8.51	\$284.25	\$902.51	\$600.22	0.41	\$1,562.19	\$1,038.94
8	1.59	\$649.17	8.94	\$298.47	\$947.64	\$594.56	0.43	\$1,640.29	\$1,029.14
9	1.67	\$681.63	9.39	\$313.39	\$995.02	\$588.95	0.45	\$1,722.31	\$1,019.43
10	1.75	\$715.71	9.86	\$329.06	\$1,044.77	\$583.39	0.47	\$1,808.42	\$1,009.81
11	1.84	\$751.50	10.35	\$345.51	\$1,097.01	\$577.89	0.49	\$1,898.85	\$1,000.29
12	1.93	\$789.07	10.87	\$362.79	\$1,151.86	\$572.44	0.52	\$1,993.79	\$990.85
13	2.03	\$828.53	11.41	\$380.93	\$1,209.45	\$567.04	0.54	\$2,093.48	\$981.50
14	2.13	\$869.95	11.98	\$399.97	\$1,269.93	\$561.69	0.57	\$2,198.15	\$972.24
15	2.24	\$913.45	12.58	\$419.97	\$1,333.42	\$556.39	0.60	\$2,308.06	\$963.07
16	2.35	\$959.12	13.21	\$440.97	\$1,400.09	\$551.14	0.63	\$2,423.46	\$953.99
17	2.47	\$1,007.08	13.87	\$463.02	\$1,470.10	\$545.94	0.66	\$2,544.64	\$944.99
18	2.59	\$1,057.43	14.56	\$486.17	\$1,543.60	\$540.79	0.69	\$2,671.87	\$936.07
19	2.72	\$1,110.30	15.29	\$510.48	\$1,620.78	\$535.69	0.73	\$2,805.46	\$927.24
20	2.86	\$1,165.82	16.05	\$536.00	\$1,701.82	\$530.64	0.76	\$2,945.73	\$918.49
21	3.00	\$1,224.11	16.86	\$562.80	\$1,786.91	\$525.63	0.80	\$3,093.02	\$909.83
22	3.15	\$1,285.31	17.70	\$590.94	\$1,876.26	\$520.67	0.84	\$3,247.67	\$901.25
23	3.31	\$1,349.58	18.58	\$620.49	\$1,970.07	\$515.76	0.88	\$3,410.05	\$892.74
24	3.47	\$1,417.06	19.51	\$651.51	\$2,068.57	\$510.89	0.93	\$3,580.56	\$884.32
25	3.65	\$1,487.91	20.49	\$684.09	\$2,172.00	\$506.07	0.98	\$3,759.59	\$875.98
26	3.83	\$1,562.31	21.51	\$718.30	\$2,280.60	\$501.30	1.02	\$3,947.56	\$867.71
27	4.02	\$1,640.42	22.59	\$754.21	\$2,394.63	\$496.57	1.08	\$4,144.94	\$859.53
28	4.22	\$1,722.44	23.72	\$791.92	\$2,514.36	\$491.89	1.13	\$4,352.19	\$851.42
29	4.43	\$1,808.57	24.90	\$831.52	\$2,640.08	\$487.25	1.19	\$4,569.80	\$843.39
30	4.65	\$1,898.99	26.15	\$873.09	\$2,772.09	\$482.65	1.25	\$4,798.29	\$835.43
31	4.89	\$1,993.94	27.46	\$916.75	\$2,910.69	\$478.10	1.31	\$5,038.20	\$827.55
32	5.13	\$2,093.64	28.83	\$962.58	\$3,056.23	\$473.58	1.37	\$5,290.11	\$819.74
33	5.39	\$2,198.32	30.27	\$1,010.71	\$3,209.04	\$469.12	1.44	\$5,554.62	\$812.01
34	5.66	\$2,308.24	31.78	\$1,061.25	\$3,369.49	\$464.69	1.51	\$5,832.35	\$804.35
35	5.94	\$2,423.65	33.37	\$1,114.31	\$3,537.96	\$460.31	1.59	\$6,123.97	\$796.76
36	6.24	\$2,544.83	35.04	\$1,170.03	\$3,714.86	\$455.97	1.67	\$6,430.17	\$789.24
37	6.55	\$2,672.08	36.79	\$1,228.53	\$3,900.60	\$451.66	1.75	\$6,751.67	\$781.80
38	6.88	\$2,805.68	38.63	\$1,289.95	\$4,095.64	\$447.40	1.84	\$7,089.26	\$774.42
39	7.22	\$2,945.96	40.56	\$1,354.45	\$4,300.42	\$443.18	1.93	\$7,443.72	\$767.12
40	7.58	\$3,093.26	42.59	\$1,422.18	\$4,515.44	\$439.00	2.03	\$7,815.91	\$759.88
Totals			773 acre-feet		\$21,893.16		\$60,099.84		

Appendix 1. Table 7. Benefit / Cost Ratio Analysis - Friendly Way Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	18
Escalation Rate	0.0%	Percent of System Wide Total Leaks	0.78%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	625
		Project cost	\$54,162.13
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$105,419.57
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.946

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	1.38	\$564.92	7.78	\$259.73	\$824.66	\$824.66	7.78	\$29,975.83	\$29,975.83
1	1.45	\$593.17	8.17	\$272.72	\$865.89	\$816.88	0.39	\$1,498.79	\$1,413.95
2	1.53	\$622.83	8.58	\$286.35	\$909.18	\$809.17	0.41	\$1,573.73	\$1,400.61
3	1.60	\$653.97	9.00	\$300.67	\$954.64	\$801.54	0.43	\$1,652.42	\$1,387.40
4	1.68	\$686.67	9.46	\$315.71	\$1,002.37	\$793.97	0.45	\$1,735.04	\$1,374.31
5	1.77	\$721.00	9.93	\$331.49	\$1,052.49	\$786.48	0.47	\$1,821.79	\$1,361.35
6	1.86	\$757.05	10.42	\$348.07	\$1,105.12	\$779.06	0.50	\$1,912.88	\$1,348.50
7	1.95	\$794.90	10.95	\$365.47	\$1,160.37	\$771.71	0.52	\$2,008.52	\$1,335.78
8	2.05	\$834.65	11.49	\$383.74	\$1,218.39	\$764.43	0.55	\$2,108.95	\$1,323.18
9	2.15	\$876.38	12.07	\$402.93	\$1,279.31	\$757.22	0.57	\$2,214.40	\$1,310.70
10	2.26	\$920.20	12.67	\$423.08	\$1,343.28	\$750.08	0.60	\$2,325.12	\$1,298.33
11	2.37	\$966.21	13.30	\$444.23	\$1,410.44	\$743.00	0.63	\$2,441.37	\$1,286.09
12	2.49	\$1,014.52	13.97	\$466.44	\$1,480.96	\$735.99	0.67	\$2,563.44	\$1,273.95
13	2.61	\$1,065.25	14.67	\$489.76	\$1,555.01	\$729.05	0.70	\$2,691.61	\$1,261.93
14	2.74	\$1,118.51	15.40	\$514.25	\$1,632.76	\$722.17	0.73	\$2,826.19	\$1,250.03
15	2.88	\$1,174.43	16.17	\$539.96	\$1,714.40	\$715.36	0.77	\$2,967.50	\$1,238.24
16	3.02	\$1,233.16	16.98	\$566.96	\$1,800.12	\$708.61	0.81	\$3,115.88	\$1,226.55
17	3.17	\$1,294.81	17.83	\$595.31	\$1,890.12	\$701.93	0.85	\$3,271.67	\$1,214.98
18	3.33	\$1,359.55	18.72	\$625.08	\$1,984.63	\$695.30	0.89	\$3,435.26	\$1,203.52
19	3.50	\$1,427.53	19.66	\$656.33	\$2,083.86	\$688.74	0.94	\$3,607.02	\$1,192.17
20	3.67	\$1,498.91	20.64	\$689.15	\$2,188.06	\$682.25	0.98	\$3,787.37	\$1,180.92
21	3.86	\$1,573.85	21.67	\$723.60	\$2,297.46	\$675.81	1.03	\$3,976.74	\$1,169.78
22	4.05	\$1,652.55	22.75	\$759.78	\$2,412.33	\$669.43	1.08	\$4,175.58	\$1,158.74
23	4.25	\$1,735.17	23.89	\$797.77	\$2,532.95	\$663.12	1.14	\$4,384.36	\$1,147.81
24	4.47	\$1,821.93	25.09	\$837.66	\$2,659.60	\$656.86	1.19	\$4,603.57	\$1,136.98
25	4.69	\$1,913.03	26.34	\$879.54	\$2,792.58	\$650.67	1.25	\$4,833.75	\$1,126.26
26	4.92	\$2,008.68	27.66	\$923.52	\$2,932.20	\$644.53	1.32	\$5,075.44	\$1,115.63
27	5.17	\$2,109.12	29.04	\$969.70	\$3,078.81	\$638.45	1.38	\$5,329.21	\$1,105.11
28	5.43	\$2,214.57	30.49	\$1,018.18	\$3,232.75	\$632.42	1.45	\$5,595.67	\$1,094.68
29	5.70	\$2,325.30	32.02	\$1,069.09	\$3,394.39	\$626.46	1.52	\$5,875.46	\$1,084.35
30	5.98	\$2,441.56	33.62	\$1,122.55	\$3,564.11	\$620.55	1.60	\$6,169.23	\$1,074.13
31	6.28	\$2,563.64	35.30	\$1,178.67	\$3,742.32	\$614.69	1.68	\$6,477.69	\$1,063.99
32	6.60	\$2,691.83	37.07	\$1,237.61	\$3,929.43	\$608.89	1.77	\$6,801.57	\$1,053.95
33	6.93	\$2,826.42	38.92	\$1,299.49	\$4,125.91	\$603.15	1.85	\$7,141.65	\$1,044.01
34	7.27	\$2,967.74	40.86	\$1,364.46	\$4,332.20	\$597.46	1.95	\$7,498.74	\$1,034.16
35	7.64	\$3,116.12	42.91	\$1,432.69	\$4,548.81	\$591.82	2.04	\$7,873.67	\$1,024.41
36	8.02	\$3,271.93	45.05	\$1,504.32	\$4,776.25	\$586.24	2.15	\$8,267.36	\$1,014.74
37	8.42	\$3,435.53	47.31	\$1,579.54	\$5,015.06	\$580.71	2.25	\$8,680.72	\$1,005.17
38	8.84	\$3,607.30	49.67	\$1,658.51	\$5,265.82	\$575.23	2.37	\$9,114.76	\$995.69
39	9.28	\$3,787.67	52.15	\$1,741.44	\$5,529.11	\$569.81	2.48	\$9,570.50	\$986.29
40	9.75	\$3,977.05	54.76	\$1,828.51	\$5,805.56	\$564.43	2.61	\$10,049.02	\$976.99
Totals			994	acre-feet		\$28,148.34			\$77,271.23

Appendix 1. Table 8. Benefit / Cost Ratio Analysis - Molokai Drive Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	13
Escalation Rate	0.0%	Percent of System Wide Total Leaks	0.56%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	500
		Project cost	\$37,141.25
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$76,136.36
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	2.050

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	1.00	\$408.00	5.62	\$187.58	\$595.58	\$595.58	5.62	\$21,649.21	\$21,649.21
1	1.05	\$428.40	5.90	\$196.96	\$625.36	\$589.97	0.28	\$1,082.46	\$1,021.19
2	1.10	\$449.82	6.19	\$206.81	\$656.63	\$584.40	0.29	\$1,136.58	\$1,011.56
3	1.16	\$472.31	6.50	\$217.15	\$689.46	\$578.89	0.31	\$1,193.41	\$1,002.01
4	1.22	\$495.93	6.83	\$228.01	\$723.94	\$573.43	0.33	\$1,253.08	\$992.56
5	1.28	\$520.72	7.17	\$239.41	\$760.13	\$568.02	0.34	\$1,315.74	\$983.20
6	1.34	\$546.76	7.53	\$251.38	\$798.14	\$562.66	0.36	\$1,381.52	\$973.92
7	1.41	\$574.10	7.91	\$263.95	\$838.05	\$557.35	0.38	\$1,450.60	\$964.73
8	1.48	\$602.80	8.30	\$277.15	\$879.95	\$552.09	0.40	\$1,523.13	\$955.63
9	1.55	\$632.94	8.72	\$291.00	\$923.95	\$546.88	0.42	\$1,599.29	\$946.62
10	1.63	\$664.59	9.15	\$305.56	\$970.14	\$541.72	0.44	\$1,679.25	\$937.69
11	1.71	\$697.82	9.61	\$320.83	\$1,018.65	\$536.61	0.46	\$1,763.21	\$928.84
12	1.80	\$732.71	10.09	\$336.87	\$1,069.58	\$531.55	0.48	\$1,851.37	\$920.08
13	1.89	\$769.34	10.59	\$353.72	\$1,123.06	\$526.54	0.50	\$1,943.94	\$911.40
14	1.98	\$807.81	11.12	\$371.40	\$1,179.22	\$521.57	0.53	\$2,041.14	\$902.80
15	2.08	\$848.20	11.68	\$389.97	\$1,238.18	\$516.65	0.56	\$2,143.20	\$894.28
16	2.18	\$890.61	12.26	\$409.47	\$1,300.09	\$511.77	0.58	\$2,250.36	\$885.84
17	2.29	\$935.14	12.88	\$429.95	\$1,365.09	\$506.95	0.61	\$2,362.88	\$877.49
18	2.41	\$981.90	13.52	\$451.44	\$1,433.34	\$502.16	0.64	\$2,481.02	\$869.21
19	2.53	\$1,031.00	14.20	\$474.02	\$1,505.01	\$497.43	0.68	\$2,605.07	\$861.01
20	2.65	\$1,082.55	14.91	\$497.72	\$1,580.26	\$492.73	0.71	\$2,735.32	\$852.89
21	2.79	\$1,136.67	15.65	\$522.60	\$1,659.28	\$488.08	0.75	\$2,872.09	\$844.84
22	2.93	\$1,193.51	16.43	\$548.73	\$1,742.24	\$483.48	0.78	\$3,015.69	\$836.87
23	3.07	\$1,253.18	17.26	\$576.17	\$1,829.35	\$478.92	0.82	\$3,166.48	\$828.98
24	3.23	\$1,315.84	18.12	\$604.98	\$1,920.82	\$474.40	0.86	\$3,324.80	\$821.16
25	3.39	\$1,381.63	19.02	\$635.23	\$2,016.86	\$469.93	0.91	\$3,491.04	\$813.41
26	3.56	\$1,450.71	19.98	\$666.99	\$2,117.70	\$465.49	0.95	\$3,665.60	\$805.73
27	3.73	\$1,523.25	20.97	\$700.34	\$2,223.59	\$461.10	1.00	\$3,848.88	\$798.13
28	3.92	\$1,599.41	22.02	\$735.35	\$2,334.77	\$456.75	1.05	\$4,041.32	\$790.60
29	4.12	\$1,679.38	23.12	\$772.12	\$2,451.51	\$452.44	1.10	\$4,243.38	\$783.15
30	4.32	\$1,763.35	24.28	\$810.73	\$2,574.08	\$448.17	1.16	\$4,455.55	\$775.76
31	4.54	\$1,851.52	25.49	\$851.26	\$2,702.78	\$443.95	1.21	\$4,678.33	\$768.44
32	4.76	\$1,944.10	26.77	\$893.83	\$2,837.92	\$439.76	1.27	\$4,912.25	\$761.19
33	5.00	\$2,041.30	28.11	\$938.52	\$2,979.82	\$435.61	1.34	\$5,157.86	\$754.01
34	5.25	\$2,143.37	29.51	\$985.45	\$3,128.81	\$431.50	1.41	\$5,415.75	\$746.89
35	5.52	\$2,250.53	30.99	\$1,034.72	\$3,285.25	\$427.43	1.48	\$5,686.54	\$739.85
36	5.79	\$2,363.06	32.54	\$1,086.45	\$3,449.51	\$423.40	1.55	\$5,970.87	\$732.87
37	6.08	\$2,481.21	34.17	\$1,140.78	\$3,621.99	\$419.40	1.63	\$6,269.41	\$725.96
38	6.39	\$2,605.27	35.87	\$1,197.82	\$3,803.09	\$415.45	1.71	\$6,582.88	\$719.11
39	6.70	\$2,735.54	37.67	\$1,257.71	\$3,993.24	\$411.53	1.79	\$6,912.03	\$712.32
40	7.04	\$2,872.32	39.55	\$1,320.59	\$4,192.91	\$407.64	1.88	\$7,257.63	\$705.60
Totals			718 acre-feet		\$20,329.36		\$55,807.00		

Appendix 1. Table 9. Benefit / Cost Ratio Analysis - Peck Lane Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	34
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.47%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1800
		Project cost	\$110,638.39
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$199,125.86
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.800

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.62	\$1,067.08	14.69	\$490.61	\$1,557.68	\$1,557.68	14.69	\$56,621.01	\$56,621.01
1	2.75	\$1,120.43	15.43	\$515.14	\$1,635.57	\$1,542.99	0.73	\$2,831.05	\$2,670.80
2	2.88	\$1,176.45	16.20	\$540.89	\$1,717.34	\$1,528.43	0.77	\$2,972.60	\$2,645.61
3	3.03	\$1,235.27	17.01	\$567.94	\$1,803.21	\$1,514.01	0.81	\$3,121.23	\$2,620.65
4	3.18	\$1,297.04	17.86	\$596.33	\$1,893.37	\$1,499.73	0.85	\$3,277.29	\$2,595.92
5	3.34	\$1,361.89	18.75	\$626.15	\$1,988.04	\$1,485.58	0.89	\$3,441.16	\$2,571.43
6	3.50	\$1,429.99	19.69	\$657.46	\$2,087.44	\$1,471.56	0.94	\$3,613.22	\$2,547.18
7	3.68	\$1,501.48	20.67	\$690.33	\$2,191.81	\$1,457.68	0.98	\$3,793.88	\$2,523.15
8	3.86	\$1,576.56	21.71	\$724.85	\$2,301.41	\$1,443.93	1.03	\$3,983.57	\$2,499.34
9	4.06	\$1,655.39	22.79	\$761.09	\$2,416.48	\$1,430.31	1.09	\$4,182.75	\$2,475.76
10	4.26	\$1,738.16	23.93	\$799.14	\$2,537.30	\$1,416.81	1.14	\$4,391.89	\$2,452.41
11	4.47	\$1,825.06	25.13	\$839.10	\$2,664.16	\$1,403.45	1.20	\$4,611.48	\$2,429.27
12	4.70	\$1,916.32	26.39	\$881.06	\$2,797.37	\$1,390.21	1.26	\$4,842.06	\$2,406.35
13	4.93	\$2,012.13	27.71	\$925.11	\$2,937.24	\$1,377.09	1.32	\$5,084.16	\$2,383.65
14	5.18	\$2,112.74	29.09	\$971.36	\$3,084.10	\$1,364.10	1.39	\$5,338.37	\$2,361.17
15	5.44	\$2,218.38	30.55	\$1,019.93	\$3,238.31	\$1,351.23	1.45	\$5,605.29	\$2,338.89
16	5.71	\$2,329.30	32.07	\$1,070.93	\$3,400.22	\$1,338.49	1.53	\$5,885.55	\$2,316.83
17	5.99	\$2,445.76	33.68	\$1,124.48	\$3,570.24	\$1,325.86	1.60	\$6,179.83	\$2,294.97
18	6.29	\$2,568.05	35.36	\$1,180.70	\$3,748.75	\$1,313.35	1.68	\$6,488.82	\$2,273.32
19	6.61	\$2,696.45	37.13	\$1,239.73	\$3,936.18	\$1,300.96	1.77	\$6,813.26	\$2,251.87
20	6.94	\$2,831.27	38.99	\$1,301.72	\$4,132.99	\$1,288.69	1.86	\$7,153.92	\$2,230.63
21	7.29	\$2,972.84	40.93	\$1,366.81	\$4,339.64	\$1,276.53	1.95	\$7,511.62	\$2,209.58
22	7.65	\$3,121.48	42.98	\$1,435.15	\$4,556.63	\$1,264.49	2.05	\$7,887.20	\$2,188.74
23	8.03	\$3,277.55	45.13	\$1,506.90	\$4,784.46	\$1,252.56	2.15	\$8,281.56	\$2,168.09
24	8.43	\$3,441.43	47.39	\$1,582.25	\$5,023.68	\$1,240.74	2.26	\$8,695.64	\$2,147.64
25	8.86	\$3,613.50	49.76	\$1,661.36	\$5,274.86	\$1,229.04	2.37	\$9,130.42	\$2,127.38
26	9.30	\$3,794.18	52.24	\$1,744.43	\$5,538.61	\$1,217.44	2.49	\$9,586.94	\$2,107.31
27	9.76	\$3,983.89	54.86	\$1,831.65	\$5,815.54	\$1,205.96	2.61	\$10,066.29	\$2,087.43
28	10.25	\$4,183.08	57.60	\$1,923.24	\$6,106.31	\$1,194.58	2.74	\$10,569.60	\$2,067.73
29	10.77	\$4,392.23	60.48	\$2,019.40	\$6,411.63	\$1,183.31	2.88	\$11,098.08	\$2,048.23
30	11.30	\$4,611.84	63.50	\$2,120.37	\$6,732.21	\$1,172.15	3.02	\$11,652.99	\$2,028.90
31	11.87	\$4,842.44	66.68	\$2,226.38	\$7,068.82	\$1,161.09	3.18	\$12,235.64	\$2,009.76
32	12.46	\$5,084.56	70.01	\$2,337.70	\$7,422.26	\$1,150.13	3.33	\$12,847.42	\$1,990.80
33	13.09	\$5,338.79	73.51	\$2,454.59	\$7,793.38	\$1,139.28	3.50	\$13,489.79	\$1,972.02
34	13.74	\$5,605.73	77.19	\$2,577.32	\$8,183.05	\$1,128.54	3.68	\$14,164.28	\$1,953.42
35	14.43	\$5,886.01	81.05	\$2,706.18	\$8,592.20	\$1,117.89	3.86	\$14,872.49	\$1,934.99
36	15.15	\$6,180.31	85.10	\$2,841.49	\$9,021.81	\$1,107.34	4.05	\$15,616.12	\$1,916.73
37	15.91	\$6,489.33	89.36	\$2,983.57	\$9,472.90	\$1,096.90	4.26	\$16,396.92	\$1,898.65
38	16.70	\$6,813.80	93.82	\$3,132.75	\$9,946.54	\$1,086.55	4.47	\$17,216.77	\$1,880.74
39	17.54	\$7,154.49	98.51	\$3,289.38	\$10,443.87	\$1,076.30	4.69	\$18,077.61	\$1,863.00
40	18.41	\$7,512.21	103.44	\$3,453.85	\$10,966.06	\$1,066.14	4.93	\$18,981.49	\$1,845.42
Totals			1,878	acre-feet		\$53,169.10			\$145,956.76

Appendix 1. Table 10. Benefit / Cost Ratio Analysis - Pentz Road Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	24
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.04%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1300
		Project cost	\$113,736.17
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$140,559.43
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.236

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	1.85	\$753.23	10.37	\$346.31	\$1,099.54	\$1,099.54	10.37	\$39,967.77	\$39,967.77
1	1.94	\$790.89	10.89	\$363.62	\$1,154.52	\$1,089.17	0.52	\$1,998.39	\$1,885.27
2	2.04	\$830.44	11.43	\$381.81	\$1,212.24	\$1,078.89	0.54	\$2,098.31	\$1,867.49
3	2.14	\$871.96	12.01	\$400.90	\$1,272.86	\$1,068.71	0.57	\$2,203.22	\$1,849.87
4	2.24	\$915.56	12.61	\$420.94	\$1,336.50	\$1,058.63	0.60	\$2,313.38	\$1,832.42
5	2.36	\$961.33	13.24	\$441.99	\$1,403.32	\$1,048.64	0.63	\$2,429.05	\$1,815.13
6	2.47	\$1,009.40	13.90	\$464.09	\$1,473.49	\$1,038.75	0.66	\$2,550.51	\$1,798.01
7	2.60	\$1,059.87	14.59	\$487.29	\$1,547.16	\$1,028.95	0.69	\$2,678.03	\$1,781.04
8	2.73	\$1,112.86	15.32	\$511.66	\$1,624.52	\$1,019.24	0.73	\$2,811.93	\$1,764.24
9	2.86	\$1,168.51	16.09	\$537.24	\$1,705.75	\$1,009.63	0.77	\$2,952.53	\$1,747.60
10	3.01	\$1,226.93	16.89	\$564.10	\$1,791.04	\$1,000.10	0.80	\$3,100.16	\$1,731.11
11	3.16	\$1,288.28	17.74	\$592.31	\$1,880.59	\$990.67	0.84	\$3,255.16	\$1,714.78
12	3.32	\$1,352.69	18.63	\$621.92	\$1,974.62	\$981.32	0.89	\$3,417.92	\$1,698.60
13	3.48	\$1,420.33	19.56	\$653.02	\$2,073.35	\$972.07	0.93	\$3,588.82	\$1,682.58
14	3.66	\$1,491.35	20.54	\$685.67	\$2,177.01	\$962.90	0.98	\$3,768.26	\$1,666.70
15	3.84	\$1,565.91	21.56	\$719.95	\$2,285.87	\$953.81	1.03	\$3,956.67	\$1,650.98
16	4.03	\$1,644.21	22.64	\$755.95	\$2,400.16	\$944.81	1.08	\$4,154.51	\$1,635.41
17	4.23	\$1,726.42	23.77	\$793.75	\$2,520.17	\$935.90	1.13	\$4,362.23	\$1,619.98
18	4.44	\$1,812.74	24.96	\$833.43	\$2,646.17	\$927.07	1.19	\$4,580.34	\$1,604.69
19	4.67	\$1,903.38	26.21	\$875.11	\$2,778.48	\$918.32	1.25	\$4,809.36	\$1,589.56
20	4.90	\$1,998.55	27.52	\$918.86	\$2,917.41	\$909.66	1.31	\$5,049.83	\$1,574.56
21	5.14	\$2,098.47	28.90	\$964.81	\$3,063.28	\$901.08	1.38	\$5,302.32	\$1,559.71
22	5.40	\$2,203.40	30.34	\$1,013.05	\$3,216.44	\$892.58	1.44	\$5,567.44	\$1,544.99
23	5.67	\$2,313.57	31.86	\$1,063.70	\$3,377.26	\$884.16	1.52	\$5,845.81	\$1,530.42
24	5.95	\$2,429.24	33.45	\$1,116.88	\$3,546.13	\$875.82	1.59	\$6,138.10	\$1,515.98
25	6.25	\$2,550.71	35.12	\$1,172.73	\$3,723.43	\$867.55	1.67	\$6,445.00	\$1,501.68
26	6.56	\$2,678.24	36.88	\$1,231.36	\$3,909.61	\$859.37	1.76	\$6,767.25	\$1,487.51
27	6.89	\$2,812.15	38.72	\$1,292.93	\$4,105.09	\$851.26	1.84	\$7,105.62	\$1,473.48
28	7.24	\$2,952.76	40.66	\$1,357.58	\$4,310.34	\$843.23	1.94	\$7,460.90	\$1,459.58
29	7.60	\$3,100.40	42.69	\$1,425.46	\$4,525.86	\$835.28	2.03	\$7,833.94	\$1,445.81
30	7.98	\$3,255.42	44.83	\$1,496.73	\$4,752.15	\$827.40	2.13	\$8,225.64	\$1,432.17
31	8.38	\$3,418.19	47.07	\$1,571.57	\$4,989.76	\$819.59	2.24	\$8,636.92	\$1,418.66
32	8.80	\$3,589.10	49.42	\$1,650.14	\$5,239.24	\$811.86	2.35	\$9,068.77	\$1,405.27
33	9.24	\$3,768.56	51.89	\$1,732.65	\$5,501.21	\$804.20	2.47	\$9,522.20	\$1,392.02
34	9.70	\$3,956.98	54.49	\$1,819.28	\$5,776.27	\$796.61	2.59	\$9,998.31	\$1,378.88
35	10.18	\$4,154.83	57.21	\$1,910.25	\$6,065.08	\$789.10	2.72	\$10,498.23	\$1,365.87
36	10.69	\$4,362.57	60.07	\$2,005.76	\$6,368.33	\$781.65	2.86	\$11,023.14	\$1,352.99
37	11.23	\$4,580.70	63.07	\$2,106.05	\$6,686.75	\$774.28	3.00	\$11,574.30	\$1,340.22
38	11.79	\$4,809.74	66.23	\$2,211.35	\$7,021.09	\$766.98	3.15	\$12,153.01	\$1,327.58
39	12.38	\$5,050.22	69.54	\$2,321.92	\$7,372.14	\$759.74	3.31	\$12,760.66	\$1,315.06
40	13.00	\$5,302.74	73.02	\$2,438.01	\$7,740.75	\$752.57	3.48	\$13,398.70	\$1,302.65
Totals			1,326 acre-feet			\$37,531.13			\$103,028.30

Appendix 1. Table 11. Benefit / Cost Ratio Analysis - Stark Lane Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	33
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.43%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1450
		Project cost	\$110,141.79
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$193,269.21
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.755

Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.54	\$1,035.69	14.26	\$476.18	\$1,511.87	\$1,511.87	14.26	\$54,955.69	\$54,955.69
1	2.67	\$1,087.48	14.97	\$499.98	\$1,587.46	\$1,497.60	0.71	\$2,747.78	\$2,592.25
2	2.80	\$1,141.85	15.72	\$524.98	\$1,666.83	\$1,483.48	0.75	\$2,885.17	\$2,567.79
3	2.94	\$1,198.94	16.51	\$551.23	\$1,750.18	\$1,469.48	0.79	\$3,029.43	\$2,543.57
4	3.09	\$1,258.89	17.33	\$578.79	\$1,837.68	\$1,455.62	0.83	\$3,180.90	\$2,519.57
5	3.24	\$1,321.83	18.20	\$607.73	\$1,929.57	\$1,441.89	0.87	\$3,339.95	\$2,495.80
6	3.40	\$1,387.93	19.11	\$638.12	\$2,026.05	\$1,428.28	0.91	\$3,506.95	\$2,472.26
7	3.57	\$1,457.32	20.07	\$670.03	\$2,127.35	\$1,414.81	0.96	\$3,682.29	\$2,448.94
8	3.75	\$1,530.19	21.07	\$703.53	\$2,233.72	\$1,401.46	1.00	\$3,866.41	\$2,425.83
9	3.94	\$1,606.70	22.12	\$738.70	\$2,345.40	\$1,388.24	1.05	\$4,059.73	\$2,402.95
10	4.13	\$1,687.03	23.23	\$775.64	\$2,462.67	\$1,375.14	1.11	\$4,262.72	\$2,380.28
11	4.34	\$1,771.39	24.39	\$814.42	\$2,585.81	\$1,362.17	1.16	\$4,475.85	\$2,357.82
12	4.56	\$1,859.95	25.61	\$855.14	\$2,715.10	\$1,349.32	1.22	\$4,699.64	\$2,335.58
13	4.79	\$1,952.95	26.89	\$897.90	\$2,850.85	\$1,336.59	1.28	\$4,934.63	\$2,313.55
14	5.03	\$2,050.60	28.24	\$942.79	\$3,023.39	\$1,323.98	1.34	\$5,181.36	\$2,291.72
15	5.28	\$2,153.13	29.65	\$989.93	\$3,143.06	\$1,311.49	1.41	\$5,440.42	\$2,270.10
16	5.54	\$2,260.79	31.13	\$1,039.43	\$3,300.22	\$1,299.12	1.48	\$5,712.45	\$2,248.68
17	5.82	\$2,373.83	32.69	\$1,091.40	\$3,465.23	\$1,286.86	1.56	\$5,998.07	\$2,227.47
18	6.11	\$2,492.52	34.32	\$1,145.97	\$3,638.49	\$1,274.72	1.63	\$6,297.97	\$2,206.46
19	6.41	\$2,617.14	36.04	\$1,203.27	\$3,820.41	\$1,262.70	1.72	\$6,612.87	\$2,185.64
20	6.74	\$2,748.00	37.84	\$1,263.44	\$4,011.44	\$1,250.78	1.80	\$6,943.51	\$2,165.02
21	7.07	\$2,885.40	39.73	\$1,326.61	\$4,212.01	\$1,238.98	1.89	\$7,290.69	\$2,144.60
22	7.43	\$3,029.67	41.72	\$1,392.94	\$4,422.61	\$1,227.30	1.99	\$7,655.22	\$2,124.36
23	7.80	\$3,181.15	43.80	\$1,462.58	\$4,643.74	\$1,215.72	2.09	\$8,037.99	\$2,104.32
24	8.19	\$3,340.21	45.99	\$1,535.71	\$4,875.92	\$1,204.25	2.19	\$8,439.88	\$2,084.47
25	8.60	\$3,507.22	48.29	\$1,612.50	\$5,119.72	\$1,192.89	2.30	\$8,861.88	\$2,064.81
26	9.03	\$3,682.58	50.71	\$1,693.12	\$5,375.71	\$1,181.63	2.41	\$9,304.97	\$2,045.33
27	9.48	\$3,866.71	53.24	\$1,777.78	\$5,644.49	\$1,170.49	2.54	\$9,770.22	\$2,026.03
28	9.95	\$4,060.05	55.91	\$1,866.67	\$5,926.72	\$1,159.44	2.66	\$10,258.73	\$2,006.92
29	10.45	\$4,263.05	58.70	\$1,960.00	\$6,223.05	\$1,148.51	2.80	\$10,771.67	\$1,987.98
30	10.97	\$4,476.20	61.64	\$2,058.00	\$6,534.21	\$1,137.67	2.94	\$11,310.25	\$1,969.23
31	11.52	\$4,700.01	64.72	\$2,160.90	\$6,860.92	\$1,126.94	3.08	\$11,875.77	\$1,950.65
32	12.10	\$4,935.01	67.95	\$2,268.95	\$7,203.96	\$1,116.31	3.24	\$12,469.55	\$1,932.25
33	12.70	\$5,181.76	71.35	\$2,382.40	\$7,564.16	\$1,105.78	3.40	\$13,093.03	\$1,914.02
34	13.34	\$5,440.85	74.92	\$2,501.52	\$7,942.37	\$1,095.34	3.57	\$13,747.68	\$1,895.96
35	14.00	\$5,712.89	78.66	\$2,626.59	\$8,339.49	\$1,085.01	3.75	\$14,435.07	\$1,878.08
36	14.70	\$5,998.54	82.60	\$2,757.92	\$8,756.46	\$1,074.77	3.93	\$15,156.82	\$1,860.36
37	15.44	\$6,298.47	86.73	\$2,895.82	\$9,194.28	\$1,064.64	4.13	\$15,914.66	\$1,842.81
38	16.21	\$6,613.39	91.06	\$3,040.61	\$9,654.00	\$1,054.59	4.34	\$16,710.39	\$1,825.42
39	17.02	\$6,944.06	95.62	\$3,192.64	\$10,136.70	\$1,044.64	4.55	\$17,545.91	\$1,808.20
40	17.87	\$7,291.26	100.40	\$3,352.27	\$10,643.53	\$1,034.79	4.78	\$18,423.21	\$1,791.14
Totals			1,823	acre-feet		\$51,605.30			\$141,663.91

Appendix 1. Table 12. Benefit / Cost Ratio Analysis - Waggoner Road Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	36
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.56%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1500
		Project cost	\$101,434.87
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$210,839.14
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	2.079

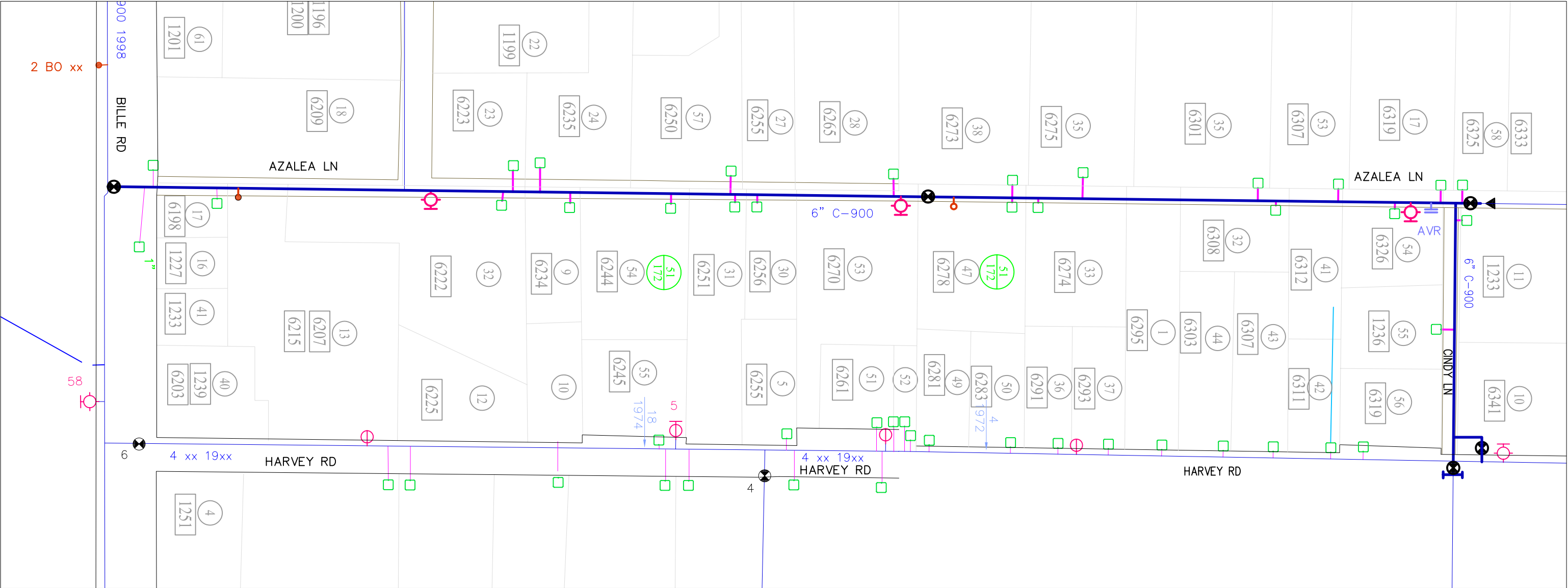
Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.77	\$1,129.85	15.56	\$519.46	\$1,649.31	\$1,649.31	15.56	\$59,951.66	\$59,951.66
1	2.91	\$1,186.34	16.34	\$545.44	\$1,731.78	\$1,633.75	0.78	\$2,997.58	\$2,827.91
2	3.05	\$1,245.66	17.15	\$572.71	\$1,818.36	\$1,618.34	0.82	\$3,147.46	\$2,801.23
3	3.21	\$1,307.94	18.01	\$601.34	\$1,909.28	\$1,603.07	0.86	\$3,304.84	\$2,774.80
4	3.37	\$1,373.34	18.91	\$631.41	\$2,004.75	\$1,587.95	0.90	\$3,470.08	\$2,748.63
5	3.53	\$1,442.00	19.86	\$662.98	\$2,104.98	\$1,572.97	0.95	\$3,643.58	\$2,722.70
6	3.71	\$1,514.10	20.85	\$696.13	\$2,210.23	\$1,558.13	0.99	\$3,825.76	\$2,697.01
7	3.90	\$1,589.81	21.89	\$730.94	\$2,320.75	\$1,543.43	1.04	\$4,017.05	\$2,671.57
8	4.09	\$1,669.30	22.99	\$767.49	\$2,436.78	\$1,528.87	1.09	\$4,217.90	\$2,646.36
9	4.30	\$1,752.76	24.13	\$805.86	\$2,558.62	\$1,514.44	1.15	\$4,428.80	\$2,621.40
10	4.51	\$1,840.40	25.34	\$846.15	\$2,686.55	\$1,500.16	1.21	\$4,650.23	\$2,596.67
11	4.74	\$1,932.42	26.61	\$888.46	\$2,820.88	\$1,486.00	1.27	\$4,882.75	\$2,572.17
12	4.97	\$2,029.04	27.94	\$932.88	\$2,961.92	\$1,471.99	1.33	\$5,126.88	\$2,547.90
13	5.22	\$2,130.49	29.34	\$979.53	\$3,110.02	\$1,458.10	1.40	\$5,383.23	\$2,523.87
14	5.48	\$2,237.02	30.80	\$1,028.50	\$3,265.52	\$1,444.34	1.47	\$5,652.39	\$2,500.06
15	5.76	\$2,348.87	32.34	\$1,079.93	\$3,428.80	\$1,430.72	1.54	\$5,935.01	\$2,476.47
16	6.04	\$2,466.31	33.96	\$1,133.93	\$3,600.24	\$1,417.22	1.62	\$6,231.76	\$2,453.11
17	6.35	\$2,589.63	35.66	\$1,190.62	\$3,780.25	\$1,403.85	1.70	\$6,543.35	\$2,429.97
18	6.66	\$2,719.11	37.44	\$1,250.15	\$3,969.26	\$1,390.61	1.78	\$6,870.51	\$2,407.04
19	7.00	\$2,855.06	39.31	\$1,312.66	\$4,167.72	\$1,377.49	1.87	\$7,214.04	\$2,384.33
20	7.35	\$2,997.82	41.28	\$1,378.29	\$4,376.11	\$1,364.49	1.97	\$7,574.74	\$2,361.84
21	7.71	\$3,147.71	43.34	\$1,447.21	\$4,594.92	\$1,351.62	2.06	\$7,953.48	\$2,339.56
22	8.10	\$3,305.09	45.51	\$1,519.57	\$4,824.66	\$1,338.87	2.17	\$8,351.15	\$2,317.49
23	8.51	\$3,470.35	47.79	\$1,595.55	\$5,065.90	\$1,326.24	2.28	\$8,768.71	\$2,295.62
24	8.93	\$3,643.87	50.17	\$1,675.32	\$5,319.19	\$1,313.73	2.39	\$9,207.15	\$2,273.97
25	9.38	\$3,826.06	52.68	\$1,759.09	\$5,585.15	\$1,301.33	2.51	\$9,667.50	\$2,252.52
26	9.85	\$4,017.36	55.32	\$1,847.04	\$5,864.41	\$1,289.06	2.63	\$10,150.88	\$2,231.27
27	10.34	\$4,218.23	58.08	\$1,939.40	\$6,157.63	\$1,276.89	2.77	\$10,658.42	\$2,210.22
28	10.86	\$4,429.14	60.99	\$2,036.37	\$6,465.51	\$1,264.85	2.90	\$11,191.34	\$2,189.36
29	11.40	\$4,650.60	64.04	\$2,138.18	\$6,788.78	\$1,252.92	3.05	\$11,750.91	\$2,168.71
30	11.97	\$4,883.13	67.24	\$2,245.09	\$7,128.22	\$1,241.10	3.20	\$12,338.46	\$2,148.25
31	12.57	\$5,127.29	70.60	\$2,357.35	\$7,484.64	\$1,229.39	3.36	\$12,955.38	\$2,127.98
32	13.20	\$5,383.65	74.13	\$2,475.22	\$7,858.87	\$1,217.79	3.53	\$13,603.15	\$2,107.91
33	13.85	\$5,652.83	77.84	\$2,598.98	\$8,251.81	\$1,206.30	3.71	\$14,283.31	\$2,088.02
34	14.55	\$5,935.47	81.73	\$2,728.93	\$8,664.40	\$1,194.92	3.89	\$14,997.47	\$2,068.32
35	15.28	\$6,232.25	85.82	\$2,865.37	\$9,097.62	\$1,183.65	4.09	\$15,747.35	\$2,048.81
36	16.04	\$6,543.86	90.11	\$3,008.64	\$9,552.50	\$1,172.48	4.29	\$16,534.71	\$2,029.48
37	16.84	\$6,871.05	94.61	\$3,159.07	\$10,030.13	\$1,161.42	4.51	\$17,361.45	\$2,010.34
38	17.68	\$7,214.61	99.34	\$3,317.03	\$10,531.63	\$1,150.46	4.73	\$18,229.52	\$1,991.37
39	18.57	\$7,575.34	104.31	\$3,482.88	\$11,058.22	\$1,139.61	4.97	\$19,141.00	\$1,972.59
40	19.50	\$7,954.10	109.52	\$3,657.02	\$11,611.13	\$1,128.86	5.22	\$20,098.05	\$1,953.98
Totals			1,989	acre-feet		\$56,296.69			\$154,542.45

Appendix 1. Table 13. Benefit / Cost Ratio Analysis - Wagstaff Road Main Replacement

Discount Rate	6.0%	Total Leaks (13 years, 1989 - 2001)	30
Escalation Rate	0.0%	Percent of System Wide Total Leaks	1.30%
Annual Rate of increase in number of pipeline leaks	5.0%	Pipeline Footage	1500
		Project cost	\$121,513.95
Average cost to repair one leak	408 dollars/leak		
Incremental cost of water treatment	33.39 dollars/acre-ft	Total Project Benefits (Operating and Capital Costs)	\$175,699.28
Total Unit Capital Cost of Capacity	3,853.56 \$/acre-ft/yr	B/C Ratio	1.446

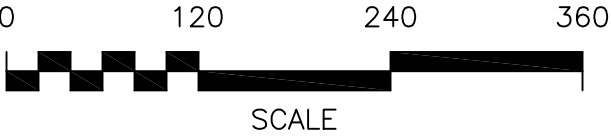
Year	Leaks avoided per year	Cost of Leaks Avoided	Water Saved per Year (acre-feet)	Cost of Water Saved	Total Operating Cost Savings	Current Value of Operating Cost Savings	Incremental Water Savings, (acre-feet)	Capital Cost Savings	Current Value of Capital Savings
0	2.31	\$941.54	12.96	\$432.89	\$1,374.43	\$1,374.43	12.96	\$49,959.71	\$49,959.71
1	2.42	\$988.62	13.61	\$454.53	\$1,443.15	\$1,361.46	0.65	\$2,497.99	\$2,356.59
2	2.54	\$1,038.05	14.29	\$477.26	\$1,515.30	\$1,348.62	0.68	\$2,622.89	\$2,334.36
3	2.67	\$1,089.95	15.01	\$501.12	\$1,591.07	\$1,335.89	0.71	\$2,754.03	\$2,312.34
4	2.81	\$1,144.45	15.76	\$526.18	\$1,670.62	\$1,323.29	0.75	\$2,891.73	\$2,290.52
5	2.95	\$1,201.67	16.55	\$552.49	\$1,754.15	\$1,310.81	0.79	\$3,036.32	\$2,268.91
6	3.09	\$1,261.75	17.37	\$580.11	\$1,841.86	\$1,298.44	0.83	\$3,188.13	\$2,247.51
7	3.25	\$1,324.84	18.24	\$609.12	\$1,933.95	\$1,286.19	0.87	\$3,347.54	\$2,226.31
8	3.41	\$1,391.08	19.15	\$639.57	\$2,030.65	\$1,274.06	0.91	\$3,514.92	\$2,205.30
9	3.58	\$1,460.64	20.11	\$671.55	\$2,132.18	\$1,262.04	0.96	\$3,690.66	\$2,184.50
10	3.76	\$1,533.67	21.12	\$705.13	\$2,238.79	\$1,250.13	1.01	\$3,875.20	\$2,163.89
11	3.95	\$1,610.35	22.17	\$740.38	\$2,350.73	\$1,238.34	1.06	\$4,068.96	\$2,143.48
12	4.14	\$1,690.87	23.28	\$777.40	\$2,468.27	\$1,226.65	1.11	\$4,272.40	\$2,123.25
13	4.35	\$1,775.41	24.45	\$816.27	\$2,591.68	\$1,215.08	1.16	\$4,486.02	\$2,103.22
14	4.57	\$1,864.18	25.67	\$857.09	\$2,721.27	\$1,203.62	1.22	\$4,710.32	\$2,083.38
15	4.80	\$1,957.39	26.95	\$899.94	\$2,857.33	\$1,192.26	1.28	\$4,945.84	\$2,063.73
16	5.04	\$2,055.26	28.30	\$944.94	\$3,000.20	\$1,181.02	1.35	\$5,193.13	\$2,044.26
17	5.29	\$2,158.02	29.72	\$992.18	\$3,150.21	\$1,169.88	1.42	\$5,452.79	\$2,024.97
18	5.55	\$2,265.92	31.20	\$1,041.79	\$3,307.72	\$1,158.84	1.49	\$5,725.43	\$2,005.87
19	5.83	\$2,379.22	32.76	\$1,093.88	\$3,473.10	\$1,147.91	1.56	\$6,011.70	\$1,986.95
20	6.12	\$2,498.18	34.40	\$1,148.58	\$3,646.76	\$1,137.08	1.64	\$6,312.29	\$1,968.20
21	6.43	\$2,623.09	36.12	\$1,206.01	\$3,829.10	\$1,126.35	1.72	\$6,627.90	\$1,949.63
22	6.75	\$2,754.25	37.92	\$1,266.31	\$4,020.55	\$1,115.72	1.81	\$6,959.29	\$1,931.24
23	7.09	\$2,891.96	39.82	\$1,329.62	\$4,221.58	\$1,105.20	1.90	\$7,307.26	\$1,913.02
24	7.44	\$3,036.56	41.81	\$1,396.10	\$4,432.66	\$1,094.77	1.99	\$7,672.62	\$1,894.97
25	7.81	\$3,188.38	43.90	\$1,465.91	\$4,654.29	\$1,084.44	2.09	\$8,056.25	\$1,877.10
26	8.21	\$3,347.80	46.10	\$1,539.20	\$4,887.01	\$1,074.21	2.20	\$8,459.07	\$1,859.39
27	8.62	\$3,515.19	48.40	\$1,616.16	\$5,131.36	\$1,064.08	2.30	\$8,882.02	\$1,841.85
28	9.05	\$3,690.95	50.82	\$1,696.97	\$5,387.92	\$1,054.04	2.42	\$9,326.12	\$1,824.47
29	9.50	\$3,875.50	53.36	\$1,781.82	\$5,657.32	\$1,044.10	2.54	\$9,792.43	\$1,807.26
30	9.97	\$4,069.27	56.03	\$1,870.91	\$5,940.19	\$1,034.25	2.67	\$10,282.05	\$1,790.21
31	10.47	\$4,272.74	58.83	\$1,964.46	\$6,237.20	\$1,024.49	2.80	\$10,796.15	\$1,773.32
32	11.00	\$4,486.38	61.78	\$2,062.68	\$6,549.06	\$1,014.82	2.94	\$11,335.96	\$1,756.59
33	11.55	\$4,710.69	64.86	\$2,165.81	\$6,876.51	\$1,005.25	3.09	\$11,902.76	\$1,740.02
34	12.12	\$4,946.23	68.11	\$2,274.10	\$7,220.33	\$995.77	3.24	\$12,497.89	\$1,723.60
35	12.73	\$5,193.54	71.51	\$2,387.81	\$7,581.35	\$986.37	3.41	\$13,122.79	\$1,707.34
36	13.37	\$5,453.22	75.09	\$2,507.20	\$7,960.42	\$977.07	3.58	\$13,778.93	\$1,691.24
37	14.03	\$5,725.88	78.84	\$2,632.56	\$8,358.44	\$967.85	3.75	\$14,467.87	\$1,675.28
38	14.74	\$6,012.17	82.78	\$2,764.19	\$8,776.36	\$958.72	3.94	\$15,191.27	\$1,659.48
39	15.47	\$6,312.78	86.92	\$2,902.40	\$9,215.18	\$949.68	4.14	\$15,950.83	\$1,643.82
40	16.25	\$6,628.42	91.27	\$3,047.52	\$9,675.94	\$940.72	4.35	\$16,748.37	\$1,628.31
Totals			1,657	acre-feet		\$46,913.91			\$128,785.38

Appendix 2. Preliminary Project Plans



SYMBOL KEY

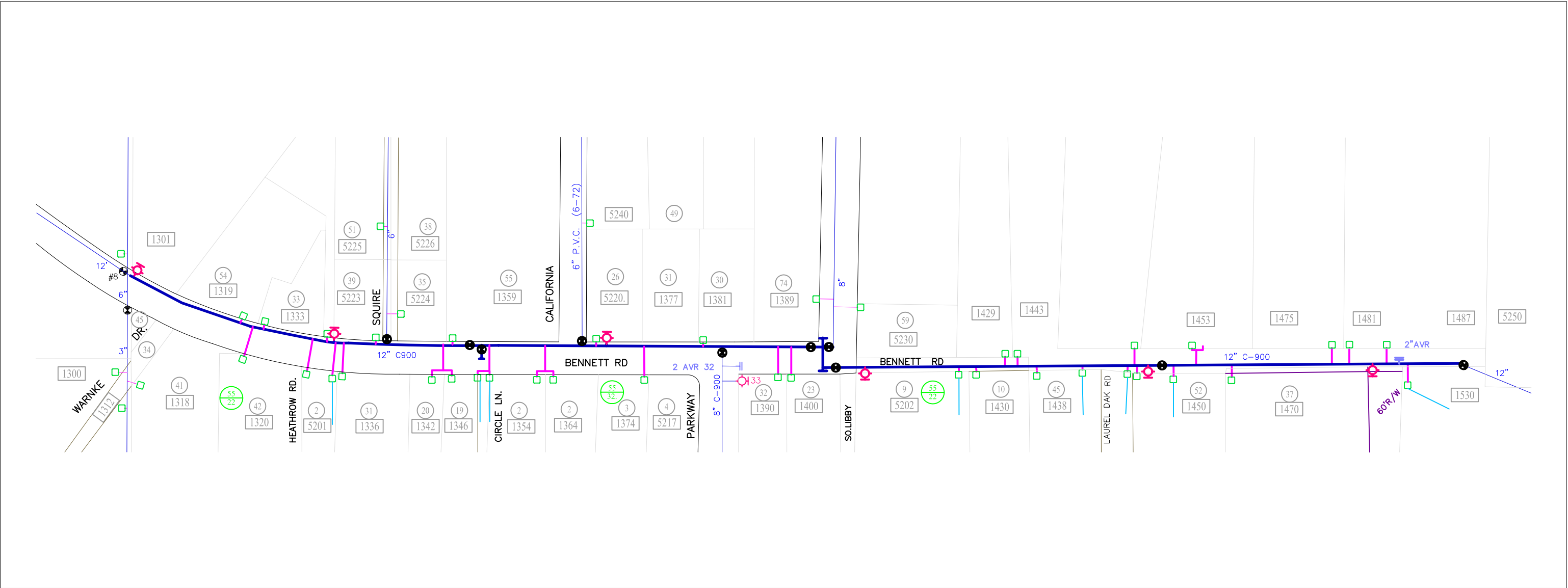
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| | PROPOSED WATER MAIN | | BLOW OFF |
| | GATE VALVE | | AIR VALVE |
| | FIRE HYDRANT | | AIR VAC |
| | METER SERVICE | | REDUCER |











Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 1
AZALEA LANE
MAIN REPLACEMENT

1,900 FEET 6-INCH WATER MAIN
PRELIMINARY DESIGN



SYMBOL KEY

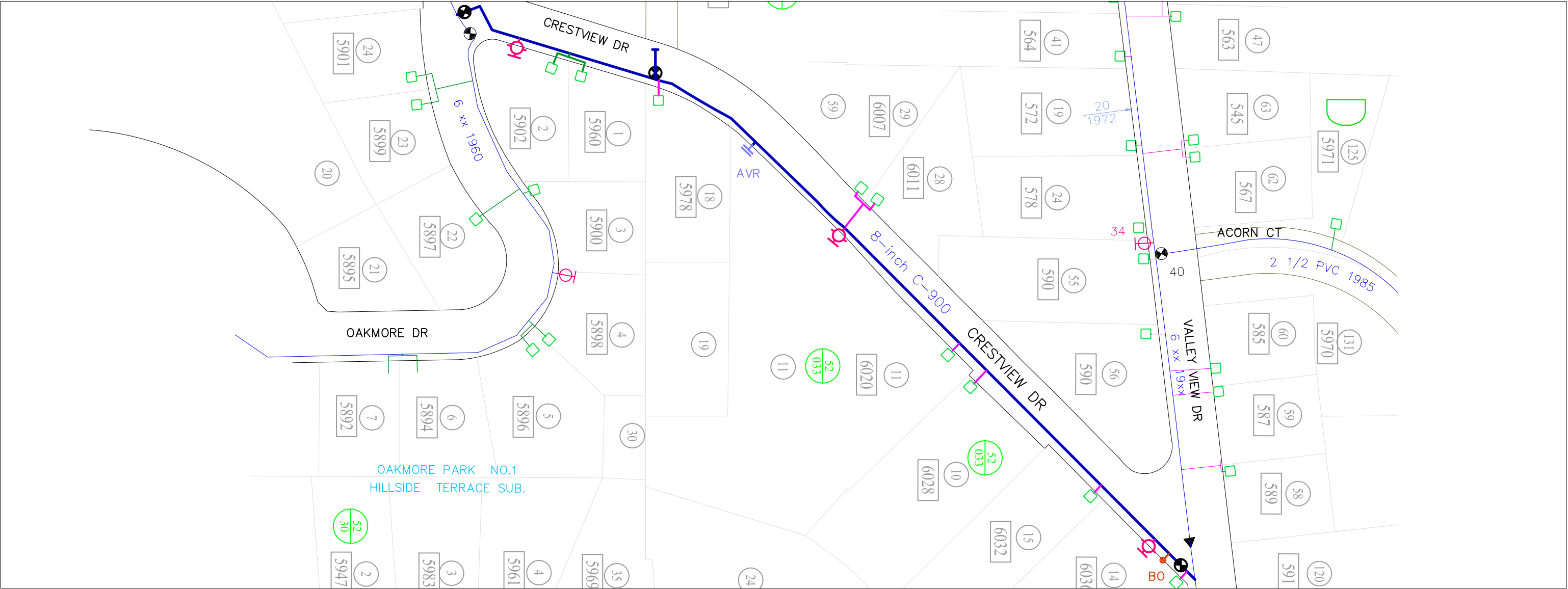
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|  | GATE VALVE |  | AIR VALVE |
|  | FIRE HYDRANT |  | AIR VAC |
|  | METER SERVICE |  | REDUCER |











Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

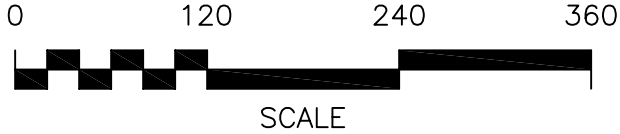
PARADISE IRRIGATION DISTRICT
PROJECT 2
BENNETT ROAD
MAIN REPLACEMENT

2,500 FEET 12-INCH WATER MAIN
PRELIMINARY DESIGN



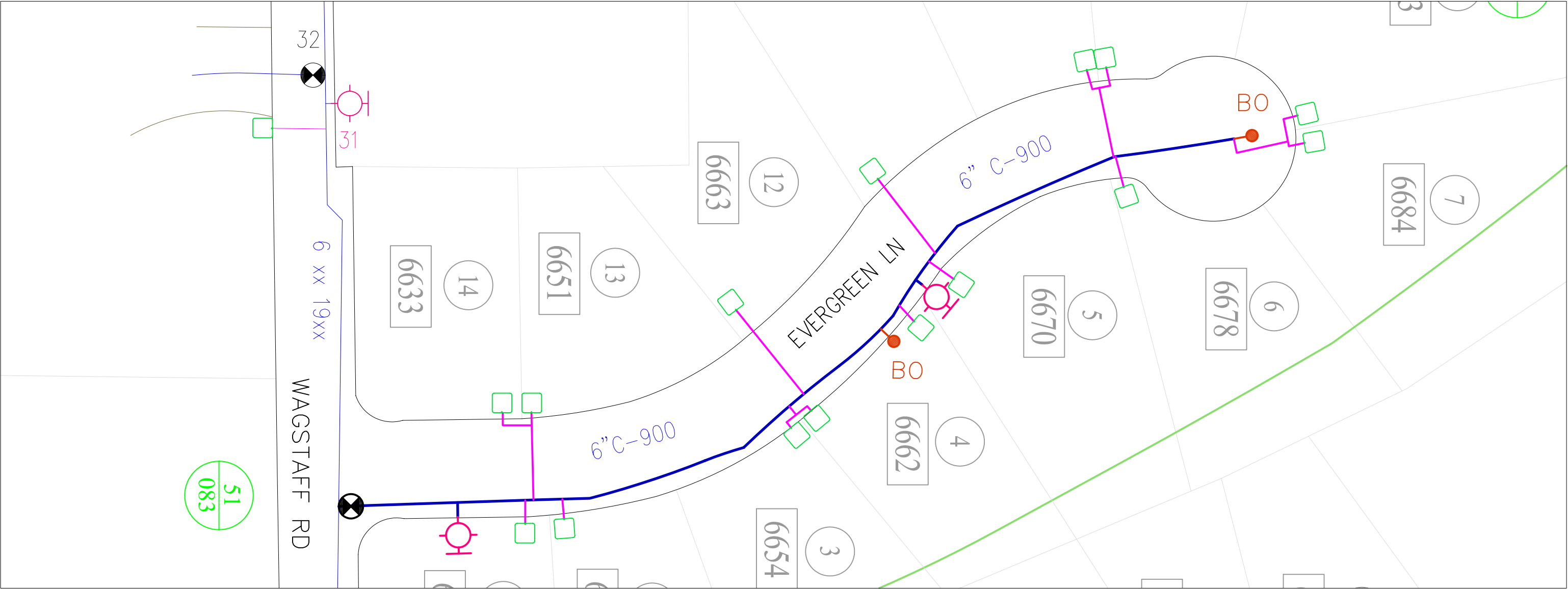
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|---|---------------------|---|-----------|
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|  | GATE VALVE |  | AIR VALVE |
|  | FIRE HYDRANT |  | AIR VAC |
|  | METER SERVICE |  | REDUCER |











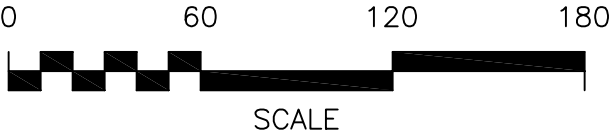
Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 4
CRESTVIEW DRIVE
MAIN REPLACEMENT
1,150 FEET 8-INCH WATER MAIN
PRELIMINARY DESIGN



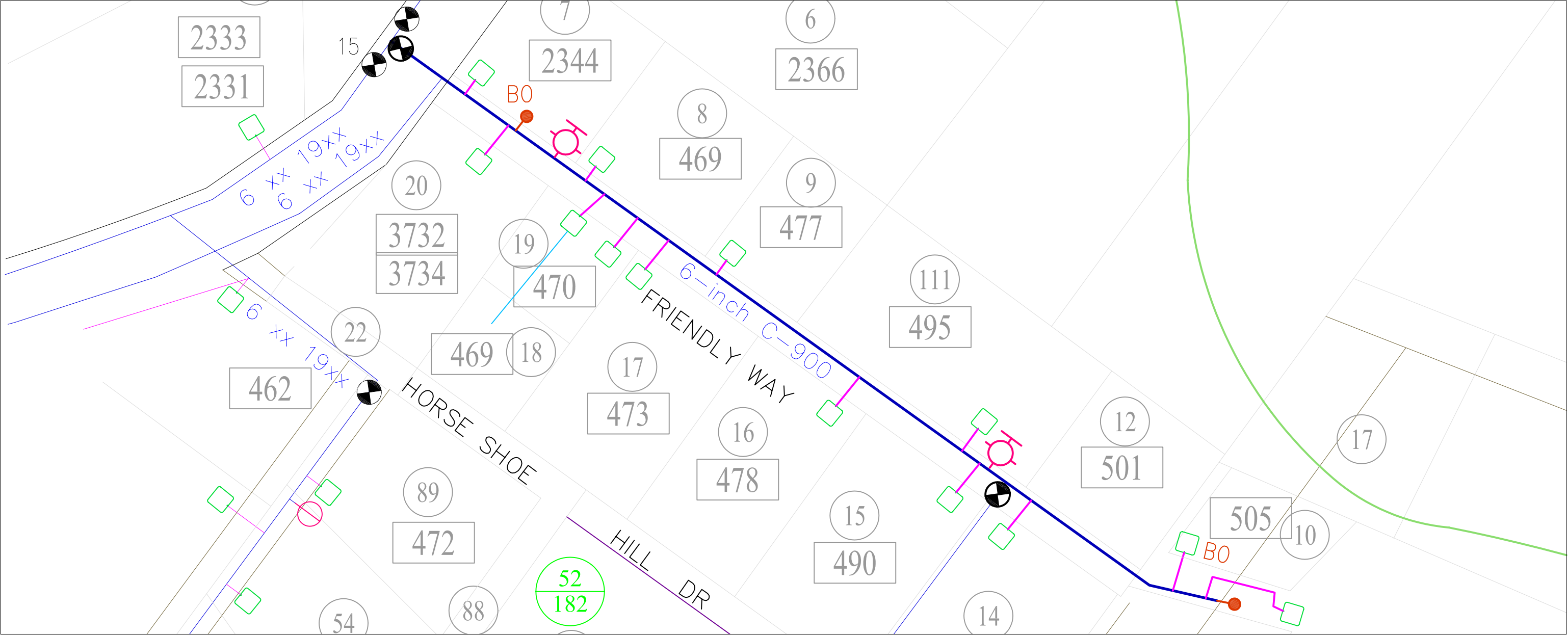
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|  | GATE VALVE |  | AIR VALVE |
|  | FIRE HYDRANT |  | AIR VAC |
|  | METER SERVICE |  | REDUCER |



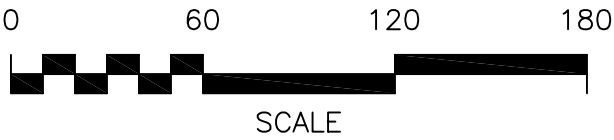
Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 6
EVERGREEN LANE
MAIN REPLACEMENT
650 FEET 6-INCH WATER MAIN
PRELIMINARY DESIGN



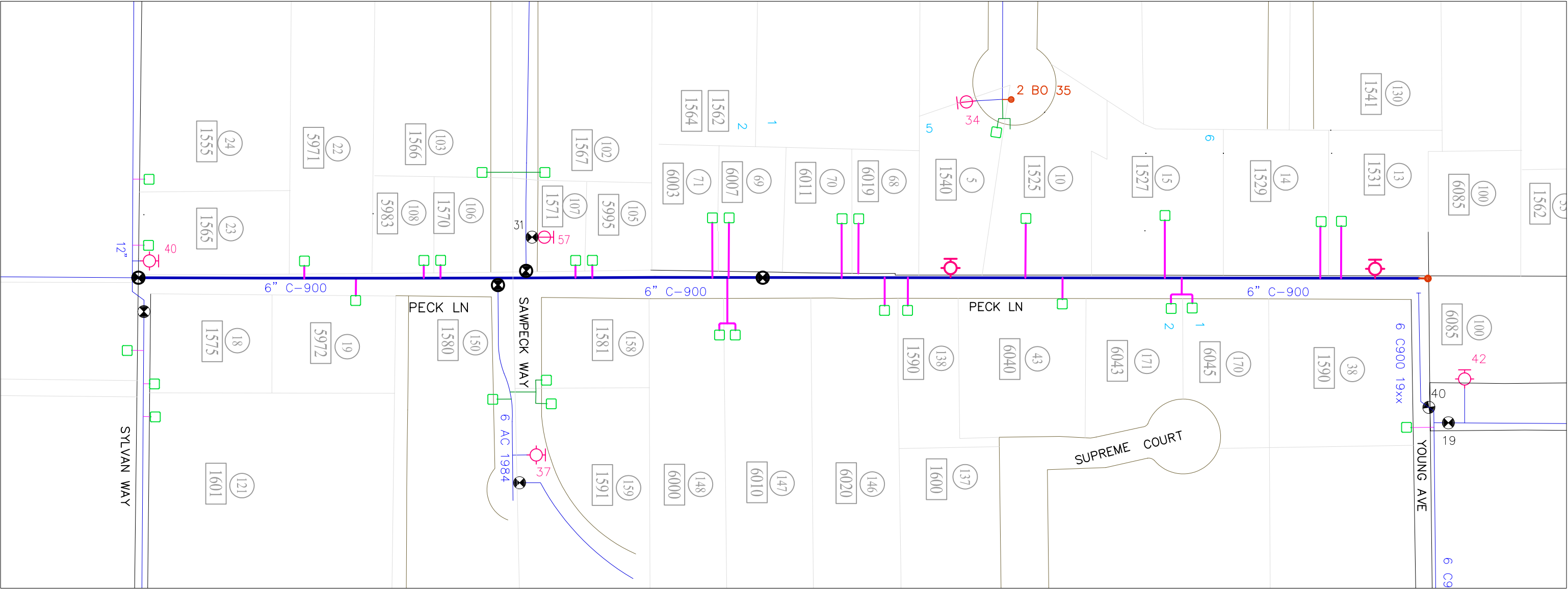
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| | GATE VALVE | | AIR VALVE |
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| | METER SERVICE | | REDUCER |



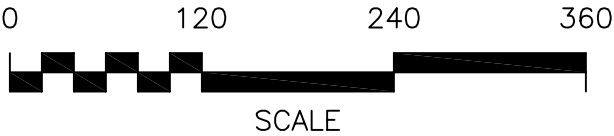
Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 7
FRIENDLY WAY
MAIN REPLACEMENT
625 FEET 6-INCH WATER MAIN
PRELIMINARY DESIGN



SYMBOL KEY

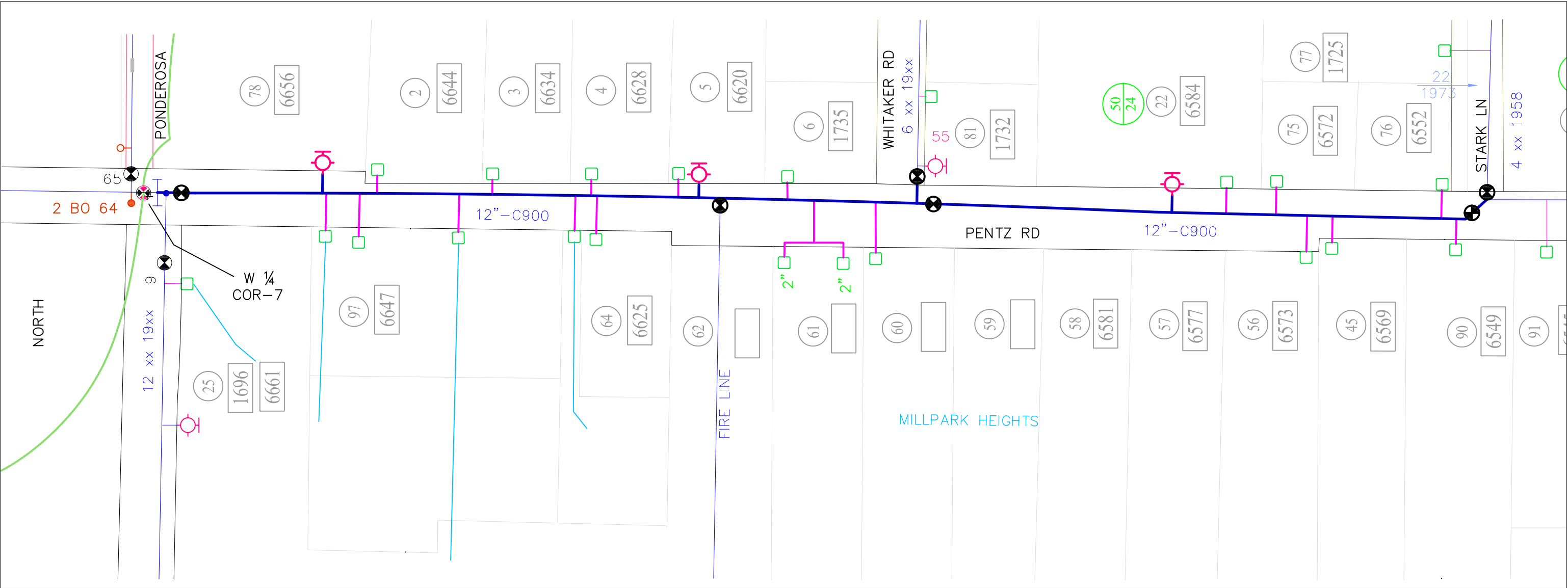
- | | | | |
|--|---------------------|--|-----------|
| | PROPOSED WATER MAIN | | BLOW OFF |
| | GATE VALVE | | AIR VALVE |
| | FIRE HYDRANT | | AIR VAC |
| | METER SERVICE | | REDUCER |



Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 9
PECK LANE
MAIN REPLACEMENT

1,800 FEET 6-INCH WATER MAIN
PRELIMINARY DESIGN



SYMBOL KEY

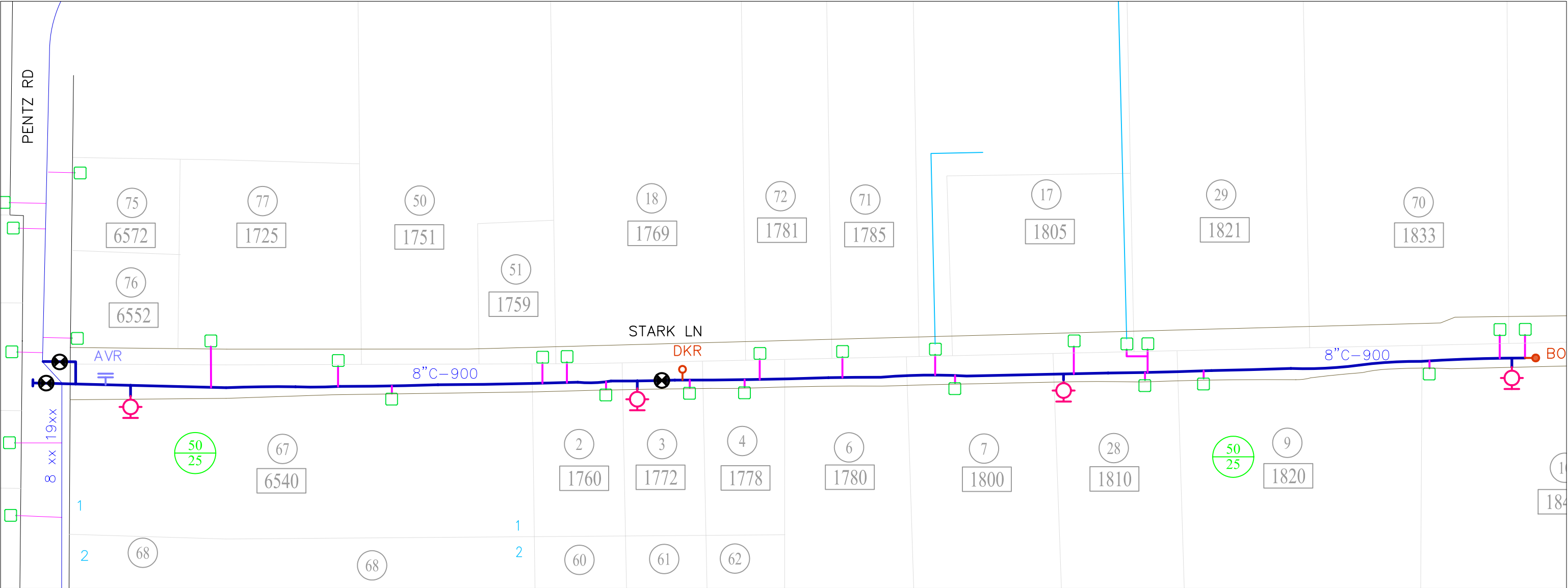
- | | | | |
|--|---------------------|--|-----------|
| | PROPOSED WATER MAIN | | BLOW OFF |
| | GATE VALVE | | AIR VALVE |
| | FIRE HYDRANT | | AIR VAC |
| | METER SERVICE | | REDUCER |



Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 10
PENTZ ROAD
MAIN REPLACEMENT

1,300 FEET 12-INCH WATER MAIN
PRELIMINARY DESIGN



SYMBOL KEY

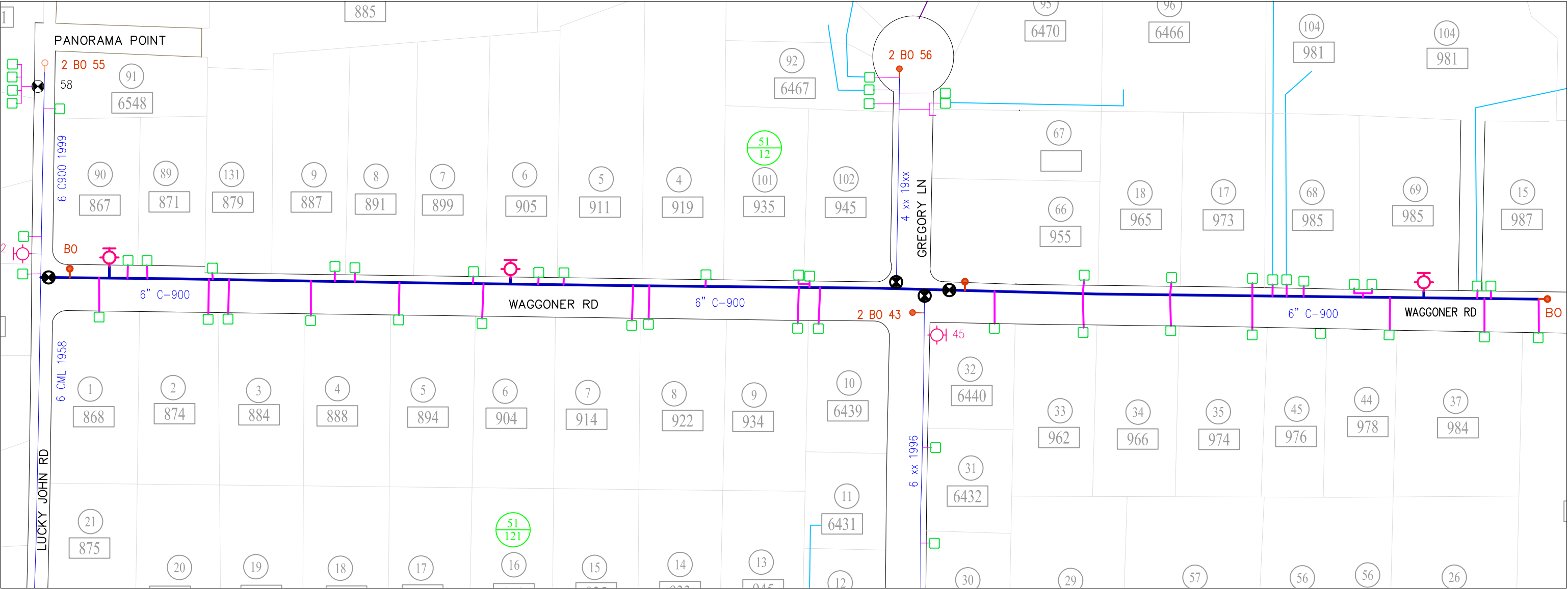
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- GATE VALVE
- FIRE HYDRANT
- METER SERVICE
- BLOW OFF
- AIR VALVE
- AIR VAC
- REDUCER



Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

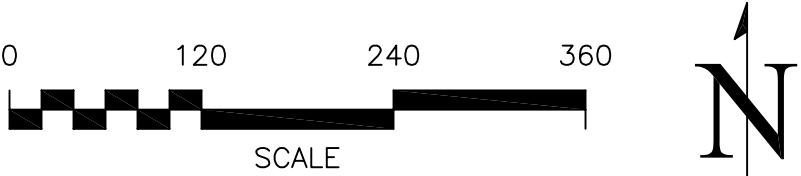
PARADISE IRRIGATION DISTRICT
PROJECT 11
STARK LANE
MAIN REPLACEMENT

1,450 FEET 8-INCH WATER MAIN
PRELIMINARY DESIGN



SYMBOL KEY

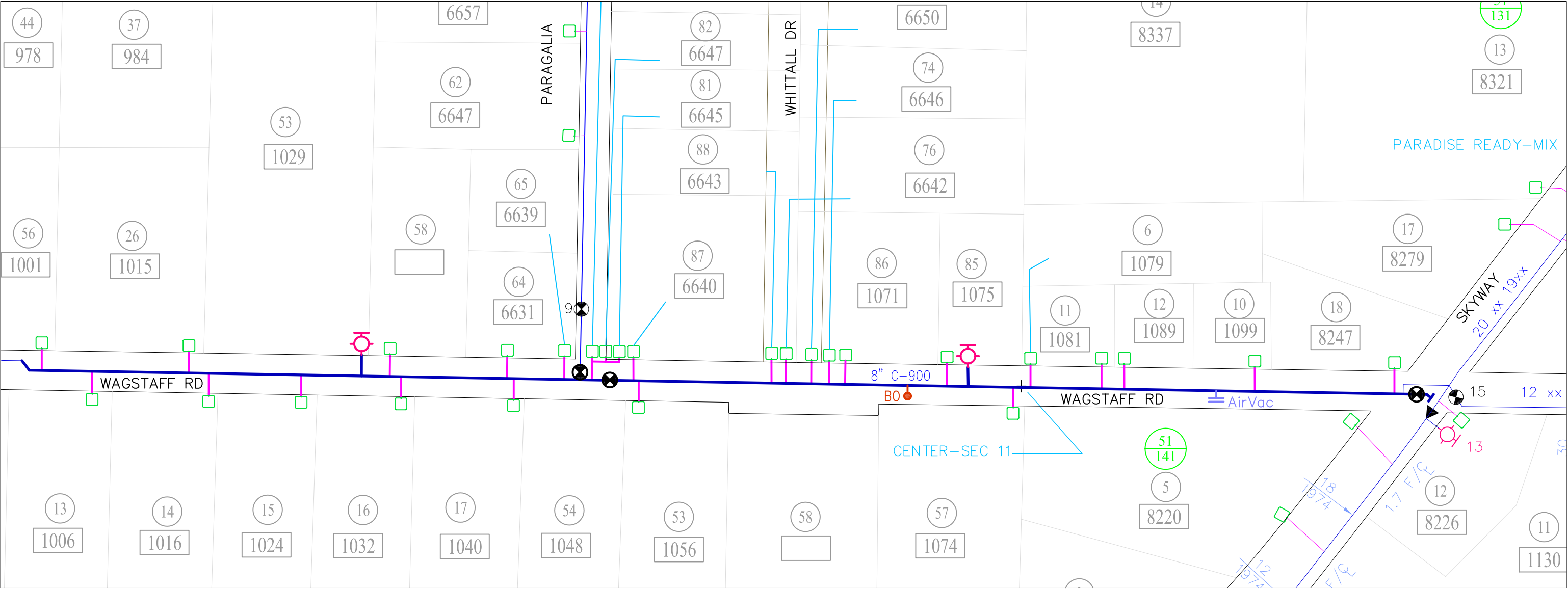
- PROPOSED WATER MAIN
- GATE VALVE
- FIRE HYDRANT
- METER SERVICE
- BLOW OFF
- AIR VALVE
- AIR VAC
- REDUCER



Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
PROJECT 12
WAGGONER ROAD
MAIN REPLACEMENT

1,500 FEET 6-INCH WATER MAIN
PRELIMINARY DESIGN



SYMBOL KEY

- | | | | |
|--|---------------------|--|-----------|
| | PROPOSED WATER MAIN | | BLOW OFF |
| | GATE VALVE | | AIR VALVE |
| | FIRE HYDRANT | | AIR VAC |
| | METER SERVICE | | REDUCER |



Prepared under the supervision of Ray Auerbach
California Registered Civil Engineer #20236

PARADISE IRRIGATION DISTRICT
WAGSTAFF ROAD
MAIN REPLACEMENT
1,500 FEET 8-INCH WATER MAIN
PRELIMINARY DESIGN

Appendix 3. Project Specifications

PARADISE IRRIGATION DISTRICT

**PIPELINE INSTALLATION
PROCEDURES AND SPECIFICATIONS**

JANUARY 1989
(UPDATED JANUARY 2000)

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DIVISION I - GENERAL REQUIREMENTS

1.01 Definition and General Information

Whenever the following words are used in these specifications or in any of the other contract documents, they shall have the meanings given herein.

- (a) The word "District" shall mean the Paradise Irrigation District, Paradise, California.
- (b) The term "Board" shall mean the Board of Directors of the Paradise Irrigation District.
- (c) The word "Manager" shall mean the manager of the Paradise Irrigation District.
- (d) The word "Contractor" shall mean:
 - 1. The person, persons, or corporation entering into contract with the District for the furnishing of material and/or the performance of work covered by these specifications, or
 - 2. Such owners and/or subdividers requesting approval of a water system project.
- (e) References to "District Standards" made in these specifications or drawings shall refer to the current applicable policies of the District. The standards herein described shall apply to all water mains installed for the District or water systems whose ownership is to be transferred to the District upon completion. On a case-by-case basis, District staff may revise standards to suit special circumstances.

1.02 Changes and Extra Work

If during progress of the work on projects contracted by the District, changes or additional work are deemed necessary by the Manager, the District shall pay the Contractor for such work in accordance with a price agreed upon in writing, prior to beginning performance of said change or additional work.

1.03 Standard Drawings

<u>Drawing Number</u>	<u>Title</u>
PID-01	Permanent End of Line Blow Off
PID-02	Thrust Block Details
03-88	6" Fire Hydrant
04-88	Utility Pits
PID-05	Copper Service Installation for ¾" to 2" Meters
PID-06	Multiple Meter Service Installation
PID-07	3" and 4" Meter Installation
08-88	Detector Check Valve
PID-09	Manual Air Valve Assembly
PID-10	Air Release and Vacuum Relief Valve Assembly
PID-11	State Health Dept. Exceptions to Basic Separation Standards for Potable Water and Sewer Pipelines

DIVISION II APPLICATION, LOCATION AND RIGHTS OF WAY

2.01 Applications, Locations and Permits

- (a) Application: All requests to install distribution mains, including those for subdivisions and lot splits, will be made by Contractor or his authorized agent, accompanied by four copies of a map approved by the P. F. D. to the Manager for checking, and the to the Board for approval. All pipeline installations shall be at the sole cost and expense of the Contractor, and shall be installed according to the District's specifications as hereinafter set forth and as set forth in the Rules and Regulation of the District. All new installations shall be connected onto District's system at a point and in a manner designated by the District. A pre-job conference between the Contractor and District staff is required to insure all specifications are understood.

Upon final inspection and testing, water will be turned off and will remain off until the following items have been received in the District office:

1. An as-built map showing details of actual location of pipe, valves, and etc.
 2. Total cost of water project, including PID charges.
 3. A legal description of the easement in which the water system is located.
 4. A signed conveyance of pipeline and/or easement, including a two (2) year guarantee of material and workmanship.
- (b) Location: Pipelines shall be so located within an easement, not less than 20 feet in width, in a manner which will meet with the District's approval for the purpose of maintenance and operation in the future. Provision may be required for an extension to adjoining lands via an easement to the District for that purpose.

- (c) Permits: The Contractor shall secure, from the agencies having jurisdiction, the necessary permits to create obstruction and to excavate for the pipelines as required and present evidence to the Manager that such permission has been granted before work is commenced. Regulations and requirements of all agencies concerned shall be strictly adhered to in the performance of this contract. The enforcement of such requirements under this contract shall not be made the basis for claims for additional compensation.

2.02 Access Rights-of-Way

Access roads or working space adjacent to work sites, which may be required by the Contractor, shall be arranged for and paid for entirely by the Contractor.

2.03 Interference with Traffic and Fire Hydrants

The Contractor shall conduct his operations so as not to close or obstruct any portion of any highway, road or street, or prevent in any way free access to fire hydrants until he has secured permission to do so from the proper authorities. The Contractor shall conduct his operations so as to avoid unnecessary interference with the flow of traffic along highways and streets.

2.04 Construction Interferences

- (a) As used in this section, the word "utility" shall be understood to include tracks, overhead or underground wires, cable, pipelines, conduits, ducts, sewers or storm drains. As used in this Section, the term "service connection" shall be understood to mean all or any portion of a pipeline conduit, wire, cable or duct, including meter, between a utility distribution line and an individual customer when served by a single service connection. As used in this Section, the term "construction interference" shall be understood to include any utility or service connection within the limits of excavation or over excavation required for the work under the contract as shown or as ordered by the Manager or any utility or service connection located in the space which will be required by any of the work under the contract.
- (b) In the event any utility or service connection is required to be disturbed or removed to permit construction of a pipeline or other structure under the contract, such disturbance or removal shall be done only with the approval of the Manager and following notification to the owner of the interfering utility or service connection. Any such utility or service connection removed or otherwise disturbed shall be reconstructed as promptly as possible in its original or other authorized location in a condition at least as good as prior to such removal or disturbance, subject to the inspection of the owner of same. The Contractor's responsibility under this Section to remove or replace shall apply even in the event such damage or destruction occurs after backfilling or is not discovered until after completion of backfilling. The owner of the utility or service connection shall be notified immediately after damage or destruction occurs or is discovered.
- (c) During the performance of the work under this contract, the owner of any utility affected by the work shall have the right to enter when necessary upon any portion of the work for the purpose of maintaining service and of making changes in or repairs to said utility.

- (d) All costs involved in removing, relocating, protecting, supporting, repairing, or replacing a utility shall be borne by the Contractor.
- (e) The Contractor shall not be assessed liquidated damages for failure to complete the work on time to the extent that such delay was caused by failure of the District or Agency having jurisdiction over the utility to authorize or otherwise provide for its relocation, removal, protection, support, repair, maintenance, or replacement.

2.05 Separation of Utilities

The installing of other utilities in a common trench with a District water main is prohibited. No utility shall be installed directly over nor within twelve (12) inches of any portion of the water system. No sewer line shall be placed in the same trench with the water line. The District's standard concerning sewer lines shall correspond to the standard of the State Department of Public Health, to wit:

STANDARD FOR SEPARATION OF WATER AND SEWER LINES

- (a) Water lines shall be laid in separate trenches as far as possible from nearby sewer lines. A minimum horizontal separation of ten (10) feet is required.
- (b) Water lines shall be laid at a higher elevation than nearby sewer lines.
- (c) When pipelines cross, the bottom of the water line shall be at least twelve (12) inches above the top of the sewer pipe.
- (d) In the event the sewer must cross above the water main, special construction methods will be required.
- (e) Steel casings or tunnels for the passage of water and sewer lines under railroad tracks, highways or other structures shall be specially designed to eliminate any hazard of contamination to the water system.
- (f) State Health Department exceptions to basic separation standards for potable water and sewer pipelines are shown in Standard Drawing PID-11.

DIVISION III - EARTHWORK

3.01 General

The Contractor shall perform all earthwork required for the complete installation of mains and all appurtenances to the required alignment and grade.

Prior to excavation notify Underground Service Alert (USA) at 1-800-227-2600.

3.02 Excavation

- (a) The Contractor shall furnish, place and maintain all supports and shoring that may be required in accordance with applicable State and Federal Industrial Safety Standards, and all pumping, ditching or other approved measures for the exclusion of water from any source so as to prevent damage to the work. Unless otherwise approved by the District, the maximum length of open trench in any one location shall be 500 feet.

(b) PIPELINE EXCAVATION

Trenches for 6" and larger water mains shall have a width equal to the outside diameter of the pipe plus twelve (12) inches. Trenches for water mains smaller than 6" may, depending upon local conditions, be narrower with District approval. The bottom of the trench shall be excavated to a depth of 4" below the bottom of the pipe and trench depth maintained deep enough to provide a minimum 30" of cover over the pipe.

(c) OVER-EXCAVATION, ORDERED

Where, in the District's opinion, the bottom of the trench is in wet or spongy material, the District may order the Contractor to over-excavate below the specified grade and refill with aggregate bedding to the bottom of the specified sand bedding. Such over-excavation will be at the Contractor's own expense.

(d) OVER-EXCAVATION

Any excavation carried below subgrade not as ordered, shall be refilled to the required grade with select material and compacted to 90 percent of maximum density. Such work shall be at the Contractor's own expense.

(e) DISPOSAL OF EXCESS EXCAVATED MATERIAL

The Contractor shall remove and dispose of all excess excavated material at his own expense.

3.03 Bedding

(a) AGGREGATE BEDDING

Where required by the District, aggregate bedding shall conform to the following: 1-1/2 inch maximum size aggregate bedding shall be placed in six (6) inch layers and compacted.

(b) SAND BEDDING

Sand Bedding shall be 1/4" minus in size and meet the approval of the District and shall be placed to a depth of four (4) inches below the grade of the bottom of the pipe. When rocky trenching conditions are encountered, over-excavation and oversanding in compacted layers, as specified by the District, will be required.

3.04 Backfill

(a) GENERAL

Materials used for backfill shall be selected free from vegetation. Materials coming into contact with the pipe shall also be free from rocks, boulders or broken masses of earth.

(b) BACKFILL IN TRENCHES (Note, Section 7.03 regarding pipe testing)

1. Pipe shall be back-filled to a level twelve (12) inches above the top of the pipe with imported sand in the following manner: If compaction by jetting is used, and approved by the District, pipe shall be backfilled with imported sand to the top of the pipe and jetted down, and around, the pipe to fill all voids, then a 12" lift above the pipe with water compaction by jetting. Flooding of the trench is not

allowable. If compaction by hand tamping is used, the pipe shall be backfilled in 4" lifts to a level 12" above the top of the pipe (See Section 6.02(d) regarding finder wire). Mechanical compactors shall not be used on top of the pipe until a minimum of 12" of hand tamped backfill above the pipe has been completed.

2. The remaining backfill shall be placed in layers six (6) inches thick or as approved by the District or as approved by the Agency having jurisdiction.

3.05 Cutting and Restoring Street Surfaces and/or Improvements

- (a) In cutting or breaking up street surfacing, the Contractor shall not use equipment that will damage adjacent pavement or other improvements. Existing paved surfaces shall be cut back beyond the edges of the trenches to form neat square cuts before repaving. All improvements damaged shall be replaced in kind or better or to specifications of the Agency having jurisdiction, at the Contractor's own expense.
- (b) All valve boxes and covers within the scope of the contract shall be adjusted to grade to the satisfaction of the District.

DIVISION IV - CONCRETE

4.01 General

Unless otherwise provided in writing, the Contractor shall furnish all materials for concrete and mortar, and shall form, mix, place, cure, repair, finish and do all other work required to produce finished concrete structures.

4.02 Concrete Mix

The concrete mix used for all concrete required hereunder shall be composed of Portland cement and properly graded sand and rock. The proportions of cement and aggregates shall be such as to produce a workable mix with a minimum compressive strength of 3,000 psi at the age of 28 days for structures, and of 1,500 psi at the age of 28 days for pipe encasement and thrust blocks. The quantity of water used shall be just sufficient, with a normal mixing period, to produce a concrete, which, in the judgment of the District, can be worked into place without segregation.

4.03 Cement

All cement used on the work shall be a standard brand Portland cement conforming to the State of California "Specifications for Portland Cement."

4.04 Aggregates

Aggregates shall be obtained from pits approved by the District and shall conform to the State of California Standard Specifications for Concrete Aggregates. Coarse aggregate shall be of 1-1/2" maximum size.

4.05 Water

Water shall be clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities.

4.06 Forms

Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. Forms shall be required for all exposed concrete surfaces, including the interior surfaces of all underground structures. All forms shall be smooth. Forms shall not be removed until the District has given permission to do so.

4.07 Tamping

As concrete is placed in forms or in excavations, it shall be thoroughly settled and compacted throughout the entire depth of the layer that is being consolidated, into a dense homogeneous mass. Except in special cases where the District deems their use impracticable, the Contractor shall use high-speed internal vibrators of an approved immersion type.

4.08 Curing

All structural concrete shall be cured by being kept moist for 14 days after placing, or at the option of the Contractor, may be cured by an impervious membrane of a type approved by the District. Encasement concrete, concrete cradle and anchor blocks, if any, may be covered with earth 24 hours after placing.

4.09 Ready-Mixed Concrete

At the Contractor's option, ready-mixed concrete may be used which meets the requirements as to materials, batching, mixing, transporting and placing as specified herein and the requirements of the "State of California Specifications for Ready-Mixed Concrete." The quality and quantity of materials used in ready-mixed concrete and in batched aggregates shall be subject to inspection at the batching plant.

DIVISION V – APPURTENANCES

5.01 Gate Valves

Valves shall be installed at points designated by the District. Each valve shall be enclosed in a concrete valve box with cover, or as specified by the District.

Gate valves larger than 2" shall be equal in diameter to the pipe, or as specified, and shall meet AWWA standards. They shall have 2-inch operating nuts. If the depth from finish grade to the top of valve nut exceeds 42 inches a valve stem extension is required. The extension shall be fabricated with a 2-inch nut at a depth of 15 inches (± 3 inches) from finished grade.

2-inch and smaller gate valves shall be Milwaukee, Grinnell, Nibco, or equal, and shall meet AWWA standards.

5.02 Blow Offs

Blow off valves and connections of at least two (2) inch diameter shall be installed at points designated by the District and provisions made for taking care of waste

water either in gutters or easements for water run off. Each blow off valve shall be enclosed in a suitable enclosure with lid (see 5.01).

5.03 Air Valves

A combination air release vacuum valve of at least one (1) inch shall be installed at all high points in the lines. Covers for air valves shall be such that drainage will not enter valve box but will permit sufficient air to enter so as not to impair the operation of the air valve. The type of box and cover is subject to the approval of the District.

5.04 Fire Hydrants

- (a) Requests for system extensions shall be accompanied by 4 copies of the proposed extension showing fire hydrant number and location and approved by the Paradise Fire Department.
- (b) Gate valves that serve fire hydrants shall be equal in size to the hydrant lateral and meet the requirements under section 5.01, above. They shall be equipped with a flanged connection contiguous to the main.
- (c) Hydrant lateral piping shall conform to the current District specifications.
- (d) Fire hydrants shall be those approved by the Paradise Fire Department (PFD), painted yellow per PFD specification and equipped with pentagon nuts on all hydrant valve stems.

5.05 Service Laterals

Service laterals shall include all necessary pipe, valves and fittings required from the tie-in at the main to the District end of service inside the meter box and are to include the meter box with cover and customer-side shutoff valve.

DIVISION VI - INSTALLATION OF PIPING

6.01 General

- (a) TIE-IN: The District shall make all tie-ins between pipe extension and the District's system. Temporary connections may be required for pipe disinfection, flushing, and testing. (The District may elect to construct road crossings.) Costs involved in tie-ins and road crossings shall be the responsibility of the Contractor. Generally, tie-ins will be required prior to commencing pipe extension.
- (b) District staff shall determine pipe size according to potential need and subject to Board approval.
- (c) At all times when the work of installing pipe is not in progress, all openings into the pipe shall be tightly closed to prevent entrance of animals and foreign materials. The contractor shall take all precautions to prevent the pipe from floating due to water from any source, shall assume full responsibility for any damage due to water from any source and shall restore pipe to specified condition and grade at this own expense. Any pipe that has floated shall be removed from the trench and the bedding corrected (AWWA 603-78).

- (d) All pipe, couplings and rubber rings shall be inspected prior to installation. All damage or defective material shall be removed from the job site. Non-approved lubricant (which may harbor bacteria) shall not be used.
- (e) Contractor will perform field cutting and/or machining at his own expense and using his own equipment, unless otherwise specified.
- (f) Field welding of pipe joints shall conform to the requirements of the District and of the "AWWA Standards for Field Welding of Steel Water Pipe Joints."

6.02 Installation

- (a) The Contractor shall install all pipe, fittings, valves and appurtenances shown or required. All exposed piping shall be adequately supported.
- (b) The pipe sections shall be laid to true alignment, and where grade is not shown, shall have a minimum cover of 30 inches to finish grade. Bumping of the pipe in the trenches will not be permitted. Concrete thrust blocks shall be provided by Contractor where required.
- (c) Pipe shall be installed in accordance with the AWWA Standard for installation of that particular type water pipe subject to these exceptions; pipe shall not be laid using earth mounds, and to prevent accumulations of air and to enable the pipe to be drained, there shall be no high or low points where not shown on the drawings.
- (d) AC and Plastic pipelines, and all service lines, shall be provided with 12 gauge solid insulated copper wire laid along the top of the pipe following completion of sanding and compaction to the top of pipe. The wire shall be over the center and in contact with the full length of the pipe. This is to provide for locating pipes in the future. Wires are to carry a continuous circuit from all extremities of the pipelines. Ends shall be terminated by connection to existing locator wires or existing metal pipes. Portions of the wire that have been exposed, for whatever reason, shall be protected from soil contact by wrapping with electrical tape (or other approved method) before placement of backfill.
- (e) Trenches shall be reasonably dry when pipe is laid. Necessary facilities, including slings, shall be provided for properly placing pipe in the trenches without damage. The bedding shall be checked for firmness and uniformity of surface before placing each pipe section in its final position for jointing. Bell holes are required at couplings to insure firm support, the full length of the pipe.

DIVISION VII - DISINFECTION, INSPECTION, TESTING, ACCEPTANCE

7.01 Disinfection

WARNING: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

- (a) Placing of calcium hypochlorite tablets. During construction, 5-gram calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. Table 2 shows the number of tablets required for commonly used sizes of pipe. An adhesive such as Permatex No. 1 or equal shall attach the tablets to the pipe. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

Table 2. Number of 5-g Calcium Hypochlorite Tablets Required for Dose of 25mg/l

Pipe Diameter (inches)	Pipe Length (feet)				
	13 or less	18	20	30	40
	Number of 5 gram Calcium Hypochlorite Tablets *				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

* Based on 3.25 grams available chlorine per tablet. Any portion of a tablet rounded to next higher number.

- (b) Chlorinating solvent weld pipe. Solvent weld pipe is to be disinfected with sodium hypochlorite solution at a dosage to be calculated by District staff to achieve a dosage of 25 parts per million based upon the strength of the solution. Special temporary fittings may be required to inject the disinfectant.
- (c) Filling and contact time. When installation has been completed, the main shall be filled with water by District personnel at a rate such that water within the main will flow at a velocity no greater than 1 ft/s. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in pipe for at least 48 h. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.
- (d) Chlorinating valves. During the process of chlorinating the pipelines all valves and other appurtenances shall be operated while the pipeline is filled with the heavily chlorinated water.

7.02 Inspection

- (a) A pre-job conference between the Contractor and the District staff is required to insure all specifications are understood.
- (b) Contractor shall notify the District at least 24 hours prior to commencing any stage of the project, and prior to each required inspection.

- (c) The District shall inspect the Project:
 - 1. When beginning trenching and pipe installation.
 - 2. Upon completion of the entire installation (or section thereof if approved by the District) including laterals and hydrants. This inspection must be completed prior to placement of any backfill and testing.
 - 3. Upon completion of the entire project.
 - 4. As deemed necessary during construction.
- (d) Any pipe covered before inspection and approval, shall be uncovered at the Contractor's expense, for such inspection and approval.

7.03 Testing

Following District inspection and approval of the pipe system or completed sections all pipe with the exception of joints, fabricated sections and service lines shall be backfilled.

HYDROSTATIC TESTS

All parts of the entire pipeline installation shall be tested in accordance with AWWA Specification. District will flush the line of disinfectant upon completion of a satisfactory test.

FLOW TESTING

After flushing, the Paradise Fire Department will flow test any associated fire hydrants in the new pipe construction to determine that flows meet the original design specifications. Should a pipeline not meet flow design specifications the District will not accept the pipe into its system until the problem has been rectified between the Contractor, Engineer and Paradise Fire Department. The Paradise Irrigation District will not be responsible for any failures that may occur to the new pipe construction incidental to flow testing done by the Paradise Fire Department. A representative of the Contractor or Owner may be present during flow testing.

7.04 Acceptance

After the pipe has been tested to the satisfaction of the District and Paradise Fire Department the water will be turned off. After approval by the Manager and upon presentation to the District (when applicable) of a deed to the pipe system, an easement description, an accounting of total system cost, an as-built map, and also when accepted by the Board of Directors, the water will then be turned on to the pipeline for regular service.

7.05 Penalty for Unauthorized Tampering or Water Usage

Persons found to be in violation of this Section will be subject to prosecution, discontinuance of water service if applicable, or both.

- (a) Penal Code References:

1. Penal Code Section 625 makes it a misdemeanor to open, or draw water from, a valve after being notified that it has been closed for a specific reason.

OR

2. Penal Code Section 498(b) makes it a misdemeanor to obtain water without payment by: diverting it without authority, tampering with the water system, making an unauthorized connection, or knowingly using such unauthorized water.

OR

3. Penal Code Section 624 makes it a misdemeanor to willfully break, dig up, obstruct or injure any pipeline or appurtenances.

- (b) The penalty for a misdemeanor is a fine up to \$1,000, confinement in the County Jail up to six months, or both (Penal Code Section 19).
- (c) The District intends to prosecute violators of this and any other applicable sections of the penal code.

DIVISION VIII - STANDARDS AND SPECIFICATIONS FOR COPPER SERVICE LINES

8.01 Installation Standards

- (a) Material and Fittings. Services up to 2" in diameter shall be constructed of type "K" copper tubing. Larger services shall be constructed of flanged, ductile iron pipe.
- (b) Unless otherwise specified or approved by the District, flare or compression fittings (Ford Meter Box Company or equal) are to be used for connecting copper tubing to other appurtenances. Packed joint fittings are **not** allowed.
- (c) An approved tubing cutter and flaring tool shall be used to prepare copper tubing for fitting attachment. Knife and hacksaw cuts will not be allowed.
- (d) All material is to be stored in a clean, dry location, away from corrosive materials.

8.02 Installation

- (a) Connections (2-inch and smaller) to water mains are to be made at an angle of 22-1/2° above the spring line of the main from the horizontal in order to provide flexibility and avoid the bleeding of trapped air into services.
- (b) Unless otherwise specified by the District, the order of connections shall be followed as shown in Section 8.03 and Standard Drawing PID-05 and 06-88, a part of these specifications.
- (c) The copper tubing is to be laid in the trench in a "snaking" fashion to allow flexibility and thermal contraction, and all curves or bends will be gently arched with no sharp angles formed which might cause crimping or deformation of the tubing.
- (d) Only clean, select backfill is to be used, free from rocks and roots or any object that may cause a puncture or deformation in the tubing.

- (e) District approved meter boxes are required, and considered a part of new installations, and shall be set with the top of the box 2" above grade, or meet finish grade in paved areas.
- (f) Service lines shall be laid at right angles to the water main and run directly to the meter box. A tracer wire must be provided.

8.03 Parts Specifications

GENERAL: Copper tube and flare or compression connections.

SPECIFIC: For 5/8" x 3/4" singles and doubles and 1" meter singles on DI or PVC mains:
Saddle tapped with 1" opening
1" corporation stop w/flare or compression connection
1" copper tubing
1" meter angle stop
or
1" x 3/4" x 3/4" branch valve assembly
Meter Box(es)

8.04 Meter Boxes and Utility Vaults

Meter Boxes

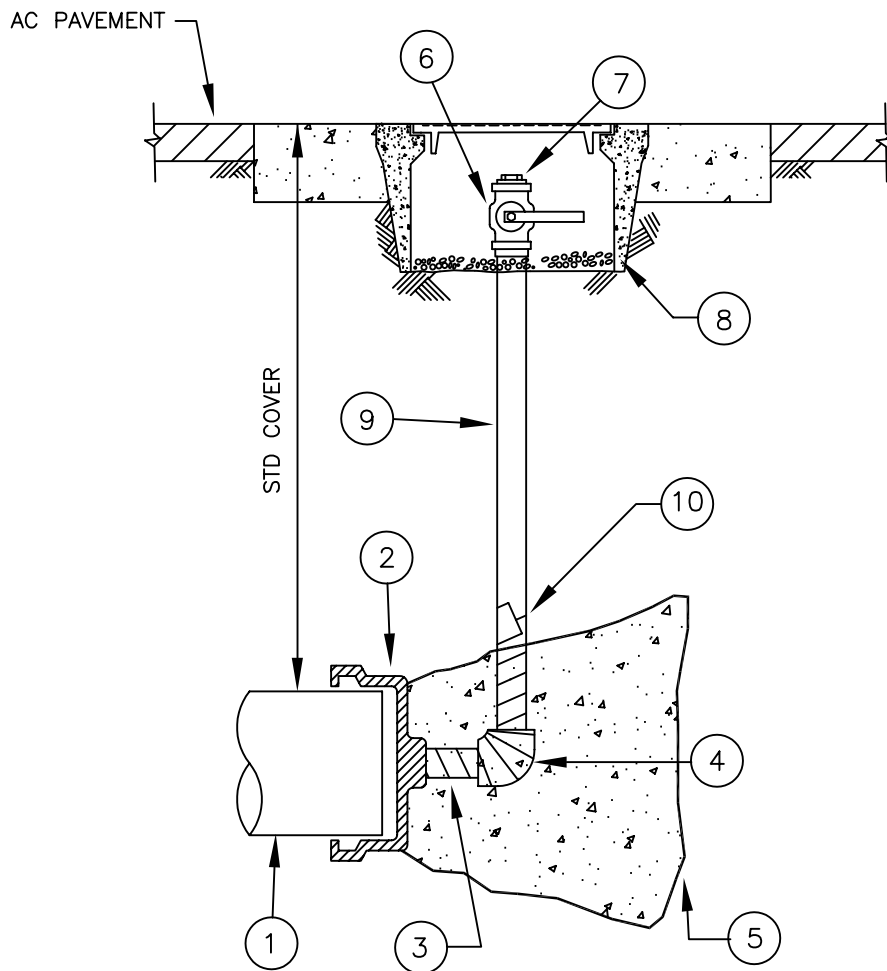
On all services 2 inches and smaller, an appropriate size and type meter box shall be installed, set at appropriate grade, which will completely enclose the meter, the meter angle stop, and the service valve. For details see Standard Drawing PID-05.

Meters 3-inch and larger shall be installed in a utility vault. For details see Standard Drawing PID-07, and below.

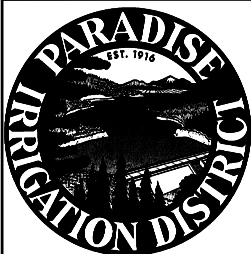
Utility Vaults

- (a) Underground vaults shall be of a size to allow working room around the facilities enclosed, and shall be precast concrete meeting the standard specifications of Forni Corporation, number WG 3050 or equal.
- (b) Lids shall meet the American Association of State Highway Officials Standard Specification H-20, when vaults are installed in traffic areas. In non-traffic areas vault lids will be as specified by the District.
- (c) All lids in traffic or pedestrian areas must be bolted down and meet the surrounding grade exactly. Any installation not conforming to a perfect finish grade transition is unacceptable.
- (d) Concrete blocking, or other methods approved by the District, must be provided to prevent settlement under vault walls and corners, and to support the valve unit(s).
- (e) Where extensions are used to bring meter boxes or vaults up to grade, all joints shall be tightly sealed by neat brickwork and/or grouting with cement.

- (f) A 12-inch depth of 3-inch drain rock is required over the bottom of the vault to help drainage and percolation. A 12-inch depth of 3-inch drain rock is required over the bottom of the vault to help drainage and percolation.
- (g) Maintain a minimum of 12 inches clearance below the valve units.
- (h) If mechanical joint or push-on fittings are used, restraining rods through the vault wall shall be required.
- (i) All vaults shall be provided with a permanent ladder installed.



- ① — 4", 6", 8", 10" OR 12" PVC OR DUCTILE IRON PIPE
- ② — TAPPED D.I. CAP
- ③ — 2" BRASS OR BRONZE NIPPLE
- ④ — 2" BRASS OR BRONZE 90° ELBOW
- ⑤ — THRUST BLOCK PER PID-02
- ⑥ — 2" BRASS FULL PORT BALL VALVE
- ⑦ — 2" BRASS M.I.P. PLUG
- ⑧ — G-12 TRAFFIC BOX WITH CAST IRON LID
(USE B-16 BOX W/LID SET 2" ABOVE GRADE OUTSIDE TRAVELED WAY)
- ⑨ — 2" BRASS OR BRONZE NIPPLE OR 2" TYPE "K" COPPER TUBING
W / I.P. X SWEAT FITTINGS EACH END
- ⑩ — EMPEDDED PIPE PRIMED W/ CALPICO 22 PRIMER
AND WRAPPED W/ 20 MIL CALPICO IDENTIFIED PV TAPE



PARADISE IRRIGATION DISTRICT STANDARD DRAWING

PERMANENT END OF LINE BLOW OFF

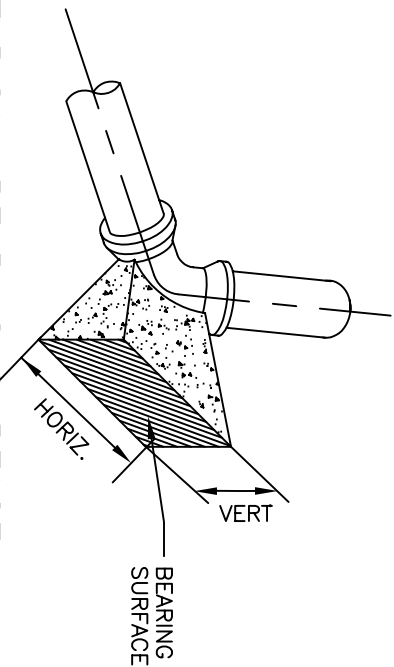
PID-01

SHEET 1 OF 1

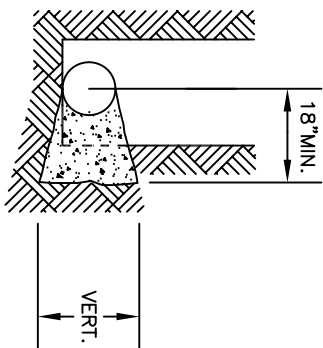
DRAWN NE CHECKED JP

DATE
DECEMBER, 1999

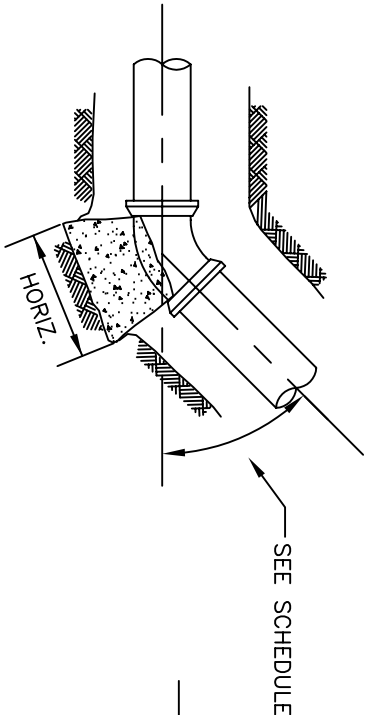
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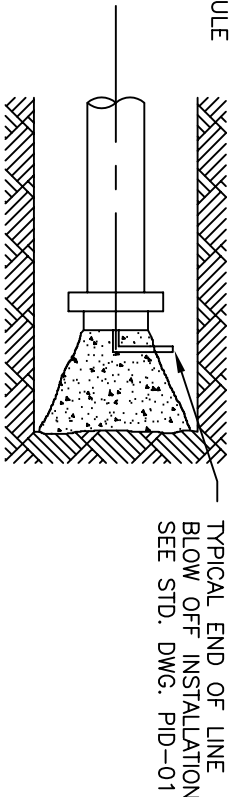
TYPICAL BEARING SURFACE



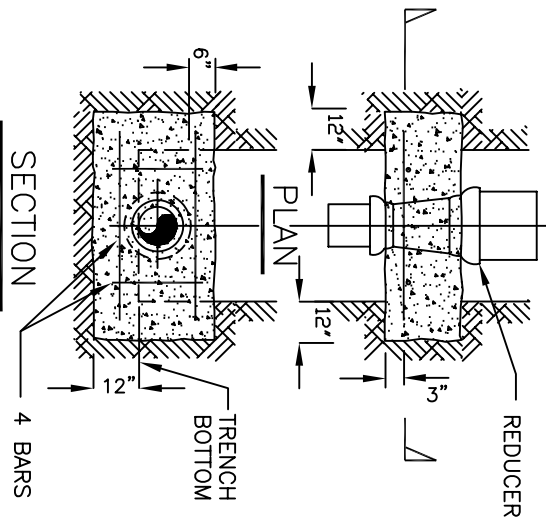
TYPICAL PROFILE



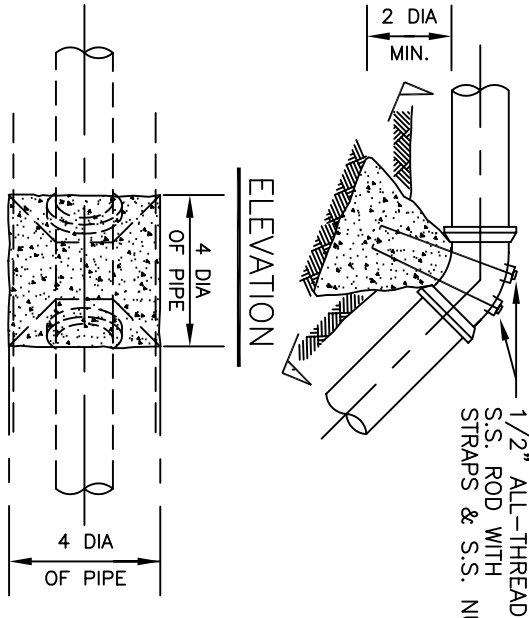
TYPICAL BEND



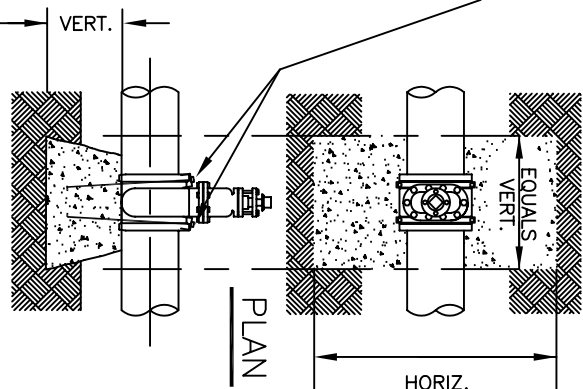
END CAP



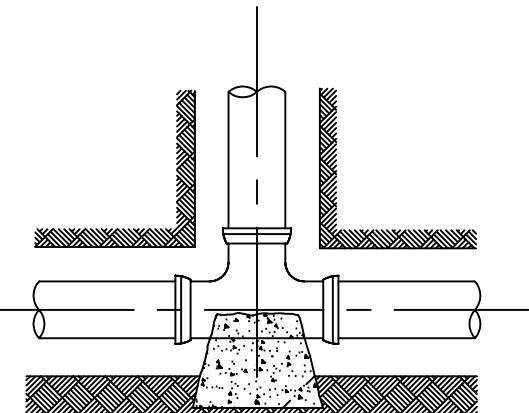
REDUCER



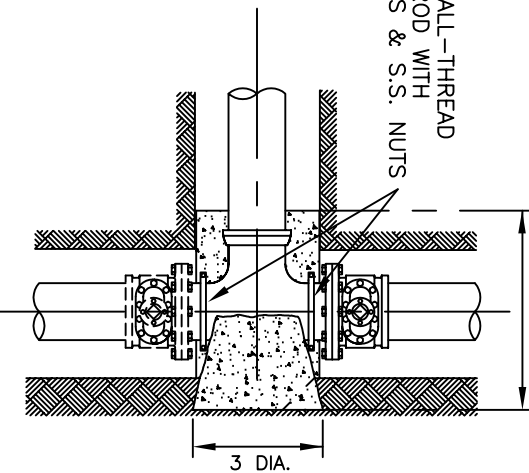
VERTICAL BEND



VALVE



W/O LINE VALVE



TEE

W/ LINE VALVE(S)

MINIMUM SIZE OF THRUST BLOCK BEARING SURFACE

PIPE SIZE	11 1/4" BEND		22 1/2" BEND		45° BEND		90° BEND		VALVE, TEE OR END CAP		VALVE & TEE	
	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.
4"	1'-0"	1'-0"	1'-0"	1'-0"	1'-4"	1'-0"	2'-4"	1'-0"	1'-8"	1'-0"	1'-4"	1'-8"
6"	1'-0"	1'-0"	1'-6"	1'-0"	2'-0"	1'-6"	3'-6"	1'-6"	2'-6"	1'-6"	2'-0"	2'-6"
8"	1'-4"	1'-0"	2'-0"	1'-4"	2'-8"	2'-0"	4'-8"	2'-0"	3'-4"	2'-0"	2'-8"	3'-4"
10"	1'-8"	1'-3"	2'-6"	1'-8"	3'-4"	2'-6"	6'-0"	2'-6"	4'-2"	2'-6"	3'-4"	4'-2"
12"	2'-0"	1'-6"	3'-0"	2'-0"	4'-0"	3'-0"	7'-0"	3'-0"	5'-0"	3'-0"	4'-0"	5'-0"

NOTES:

1. THRUST BLOCK BEARING AREA BASED ON ALLOWABLE SOIL BEARING VALUE OF 2,000 psf PRESSURE AND 225 psi LINE PRESSURE WITH 30" COVER MINIMUM. FOR BEARING = 1000 psf, 2.0 X AREA SHOWN
2. WHERE THRUST BLOCK WILL HAVE LESS THAN 12" COVER ENGINEERED DESIGN IS REQUIRED.
3. PREDESIGNED THRUST RESTRAINTS ARE SUBJECT TO SITE SPECIFIC REVIEW.
4. ALL THRUST BLOCKS SHALL BE CLASS "B" CONCRETE AND PLACED AGAINST UNDISTURBED SOIL. DESIGN ENGINEER SHALL DETERMINE SIZES NOT SHOWN.
5. REINFORCING STEEL SHALL CONFORM TO ASTM A15 AND A305 INTERMEDIATE GRADE.
6. CONCRETE SHALL NOT EXTEND ONTO FLANGE OR ADJOINING PIPE.



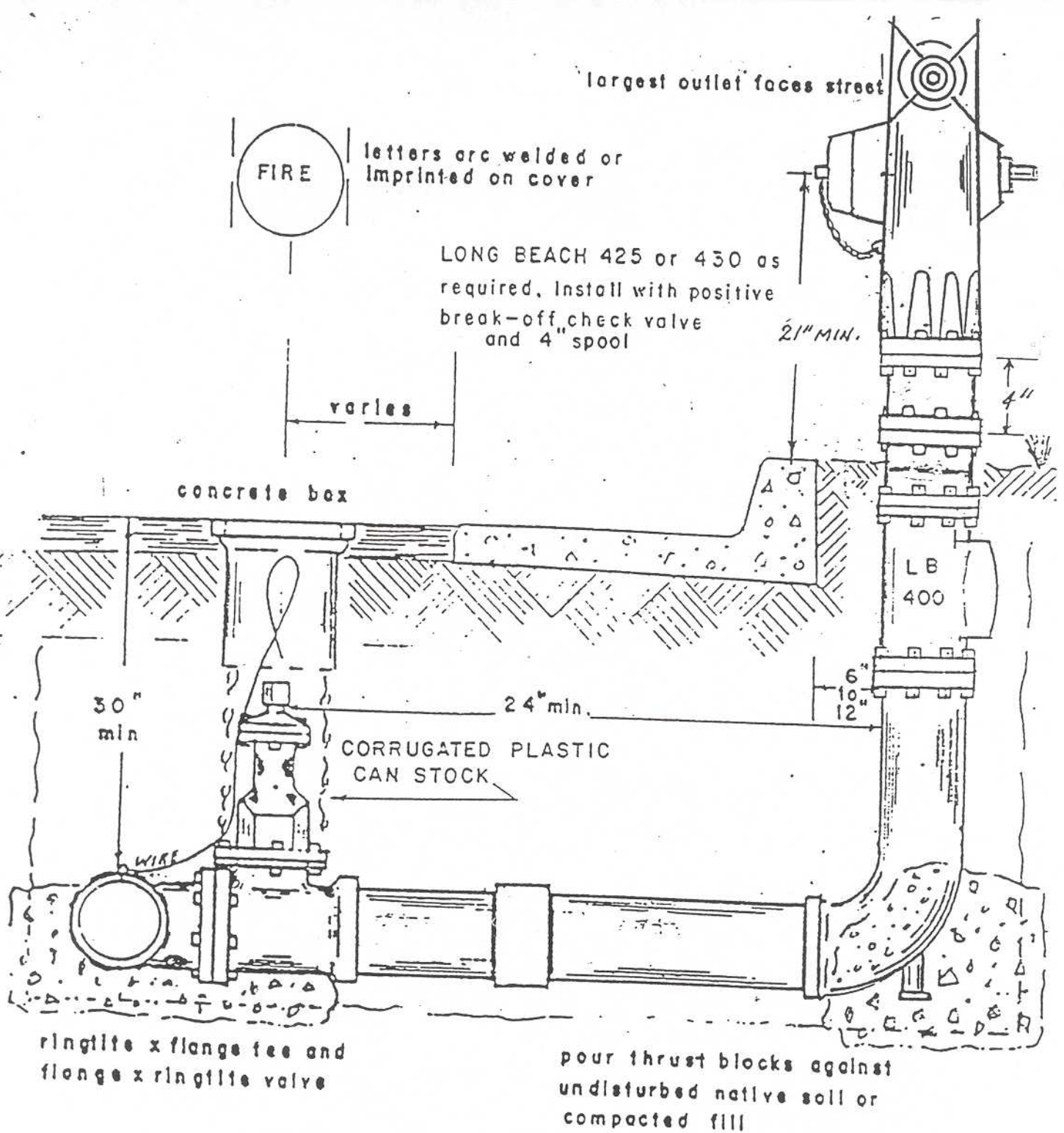
PARADISE IRRIGATION DISTRICT
STANDARD DRAWING

PID-02
SHEET 1 OF 1

THRUST BLOCK DETAILS

DRAWN
NE
DATE
DECEMBER, 1999
NO SCALE

CHECKED
JP



PARADISE IRRIGATION DISTRICT

P.F.D. approved, 6" fire hydrant

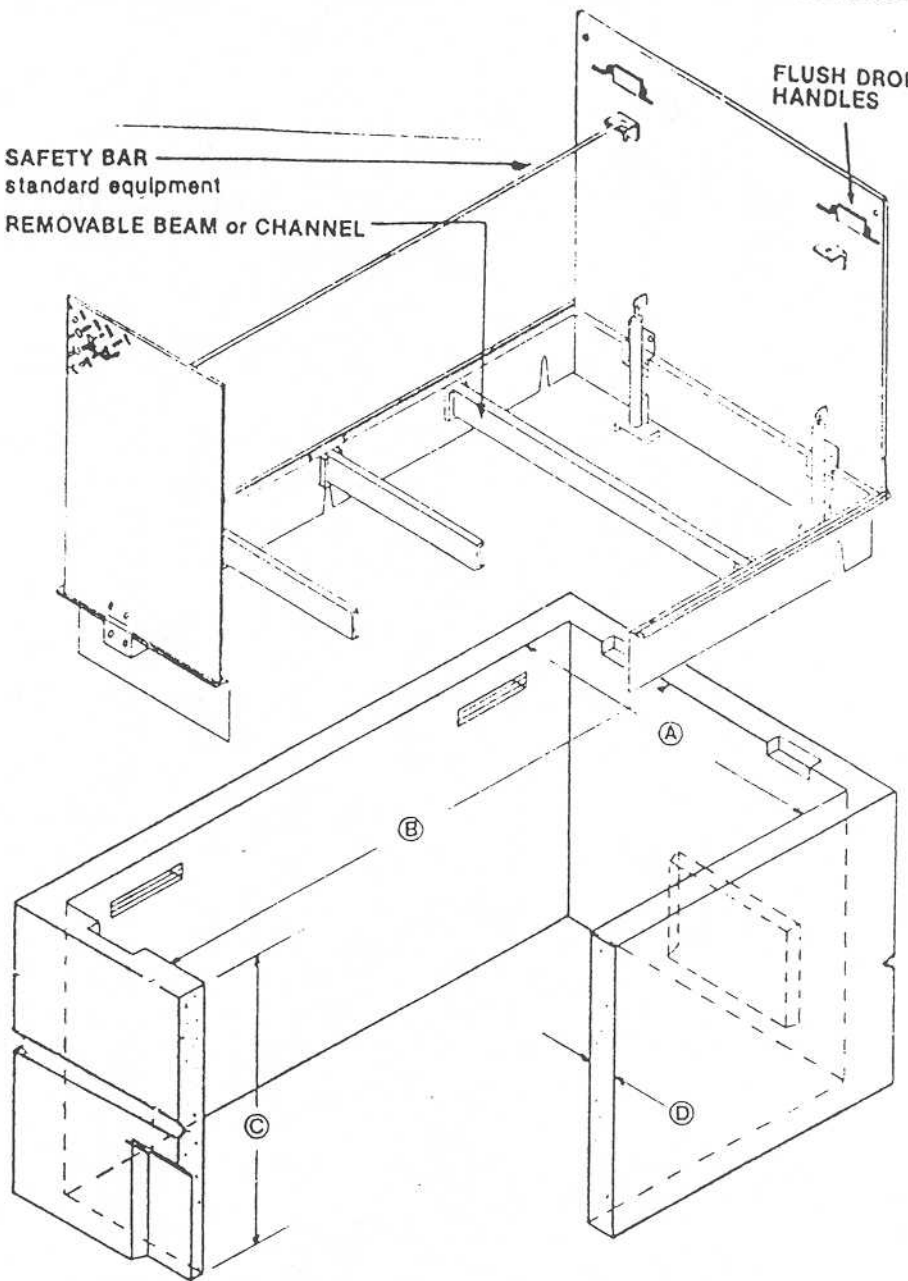
standard no. 03-38

HINGED SPRING
ASSIST GALVANIZED
FULL TRAFFIC COVER

SAFETY BAR
standard equipment

REMOVABLE BEAM or CHANNEL

FLUSH DROP
HANDLES



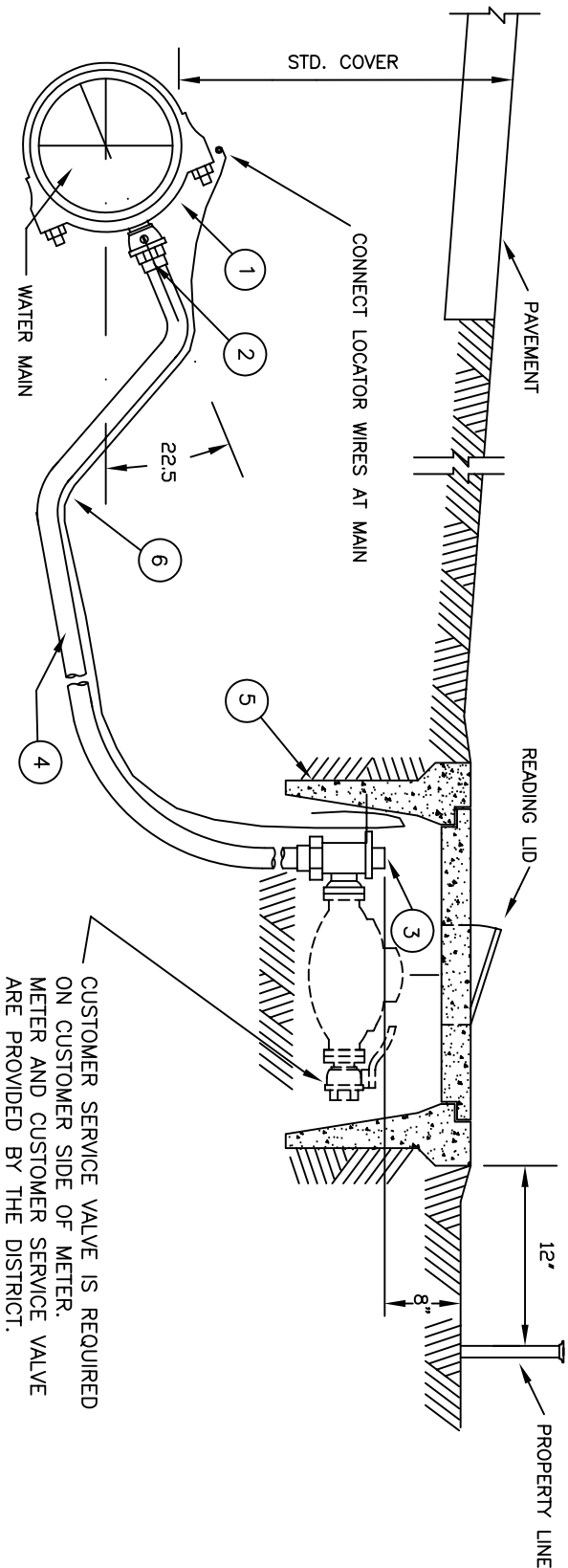
PITS DESIGNED FOR H-20-44 LOAD RATING.

ALL STEEL, OTHER THAN REBAR, TO BE HOT DIPPED AND GALVANIZED AFTER FABRICATION.

UTILITY PITS

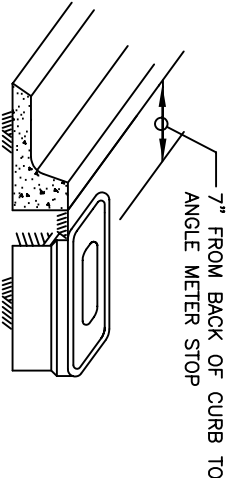
PARADISE IRRIGATION DISTRICT

STANDARD NO. 04-88

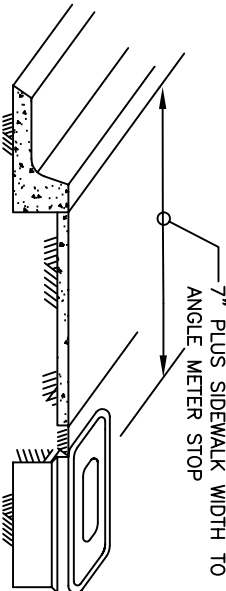


CUSTOMER SERVICE VALVE IS REQUIRED ON CUSTOMER SIDE OF METER. METER AND CUSTOMER SERVICE VALVE ARE PROVIDED BY THE DISTRICT.

WITH CURB AND GUTTER



WITH CURB, GUTTER AND SIDEWALK



MATERIALS

ITEM NO.	SIZE & DESCRIPTION	MANUFACTURER	SPEC. NO.
①	DOUBLE S.S. STRAP DUCTILE IRON SERVICE SADDLE W/ I.P. OUTLET	ROMAC FORD ROCKWELL	
②	BRONZE CORPORATION STOP I.P. THREAD X COMPRESSION OR FLARE	MUELLER FORD JONES	
③	BRONZE ANGLE METER STOP W/LOCKWING (COMPRESSION OR FLARE TYPE)	JONES FORD	
④	COPPER TUBING (COPPER TYPE "K" SOFT)	MUELLER HALSTEAD OR EQUAL	
⑤	METER BOX W/READING LID		METER SIZE 3/4" 1" TO 2"
	PLANTER AREAS: GREEN PLASTIC BOX & LID	CARSON	14-19
	PAVEMENT AREAS: CONCRETE BOX AND LID	CHRISTY	B-16
⑥	12 GAUGE SOLID INSULATED COPPER WIRE	SEE SPECS.	

NOTES:

- SERVICE SADDLE SHALL NOT BE INSTALLED WITHIN 18" OF VALVE, COUPLING, JOINT OR FITTING. TAPPED COUPLINGS ARE NOT PERMITTED.
- INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
- BOX COVER TO BE SET TO CONFORM TO PLANTER GRADE IN UNPAVED AREAS. SURROUNDING GROUND SHALL DRAIN AWAY FROM BOX. SET TOP OF METER BOX FLUSH WITH SIDEWALK OR CURB WHERE APPLICABLE.
- THE CORPORATION STOP TAP SHALL BE MADE AS SPECIFIED BY THE PIPE MANUFACTURER'S INSTALLATION GUIDE. ALL TAPS SHALL BE MADE WITH MACHINE GUIDE OR PILOT TAP.
- THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
- METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB.
- COPPER TUBING SHALL NOT BE SPLICED.
- FOR MULTIPLE METER SERVICE INSTALLATION REFER TO STANDARD DRAWING PID-06.

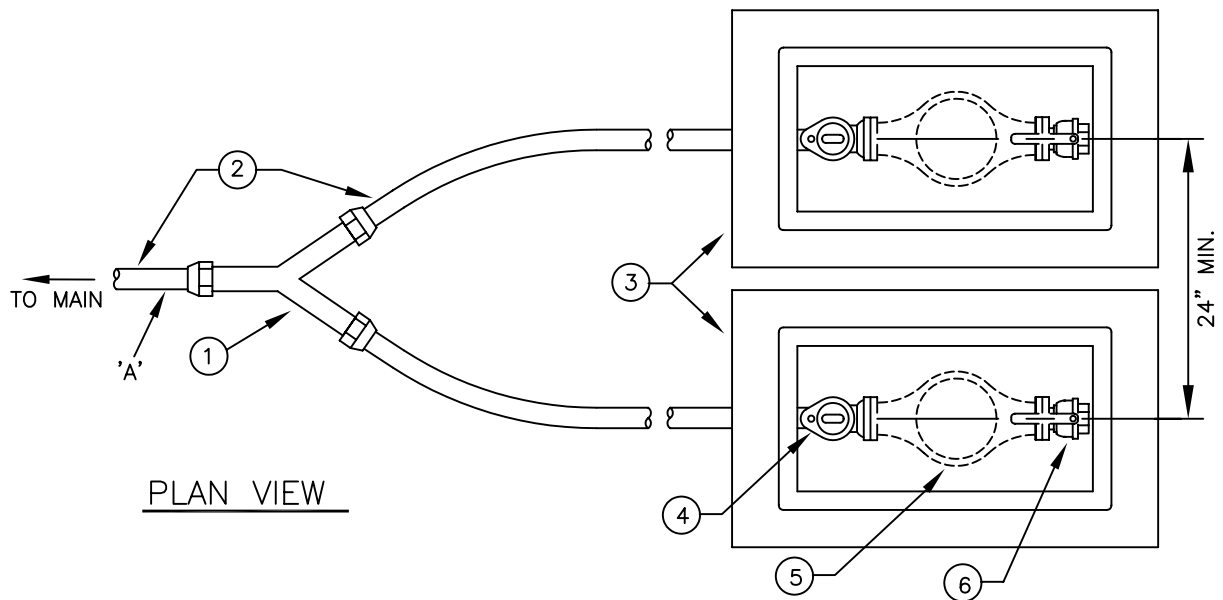


PARADISE IRRIGATION DISTRICT
STANDARD DRAWING

PID-05
SHEET 1 OF 1

COPPER SERVICE INSTALLATION
FOR 3/4" TO 2" METERS

DRAWN
NE
DATE
DECEMBER, 1999
CHECKED
JP
NO SCALE



ITEM
NO

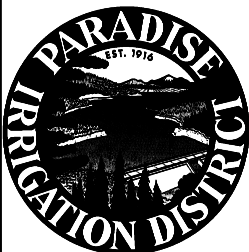
MATERIALS

- | | |
|-----|--|
| (1) | BRASS WYE FITTING, FLARE OR COMPRESSION |
| (2) | TYPE "K" SOFT COPPER TUBING |
| (3) | METER BOX W/ READING LID |
| (4) | BRONZE ANGLE METER STOP W/LOCKWING, FLARE OR COMPRESSION |
| (5) | METER (SUPPLIED BY DISTRICT) |
| (6) | BRASS FULL PORT BALL VALVE (SUPPLIED BY DISTRICT) |

METERS	MATERIAL SIZE	MIN. MAIN PRESSURE
2 @ 3/4"	1" X 3/4" X 3/4" WYE, 1" LINE 'A'	80 PSI
2 @ 1"	1 1/2" X 1" X 1" WYE, 1 1/2" LINE 'A'	60 PSI

NOTES:

- SERVICE LINE SIZE BASED ON TWO METERS, 50' MAXIMUM LINE LENGTH TO METER AND MINIMAL ELEVATION DIFFERENCE BETWEEN METER AND MAIN. CONTACT DISTRICT REGARDING OTHER SITUATIONS.
- SEE PID-05 FOR SPECIFICS ON ACCEPTABLE MATERIALS AND OTHER DETAILS.



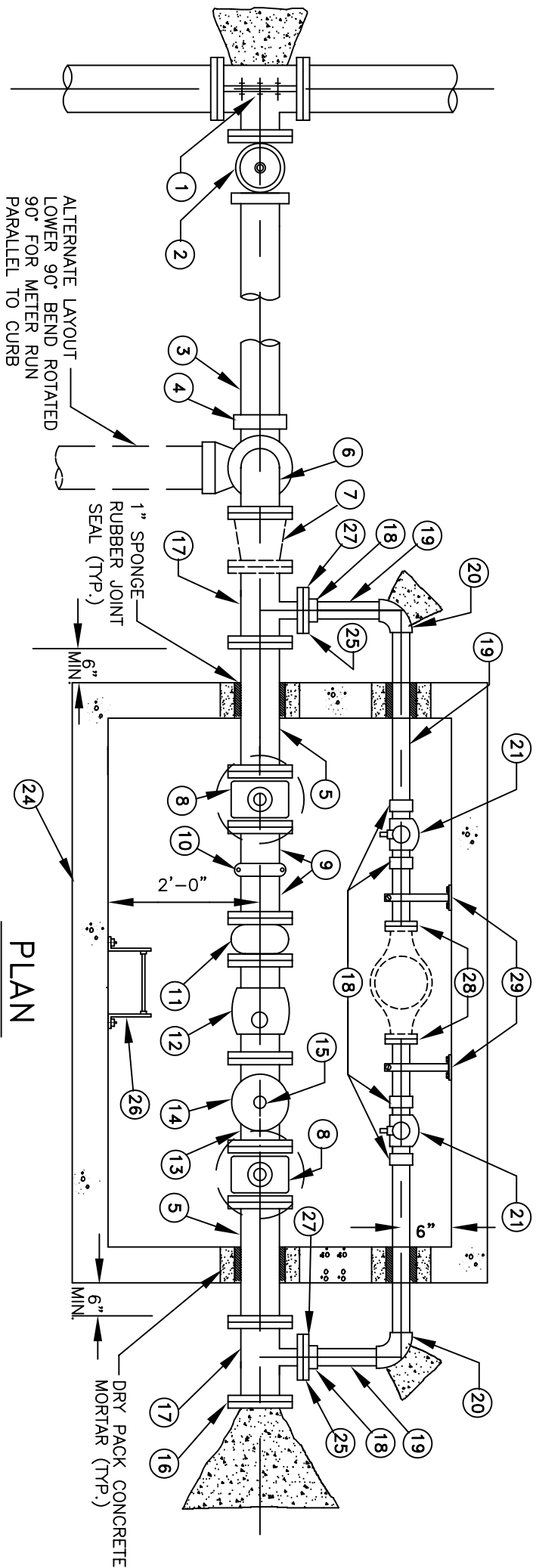
PARADISE IRRIGATION DISTRICT
STANDARD DRAWING

MULTIPLE METER SERVICE INSTALLATION

PID-06

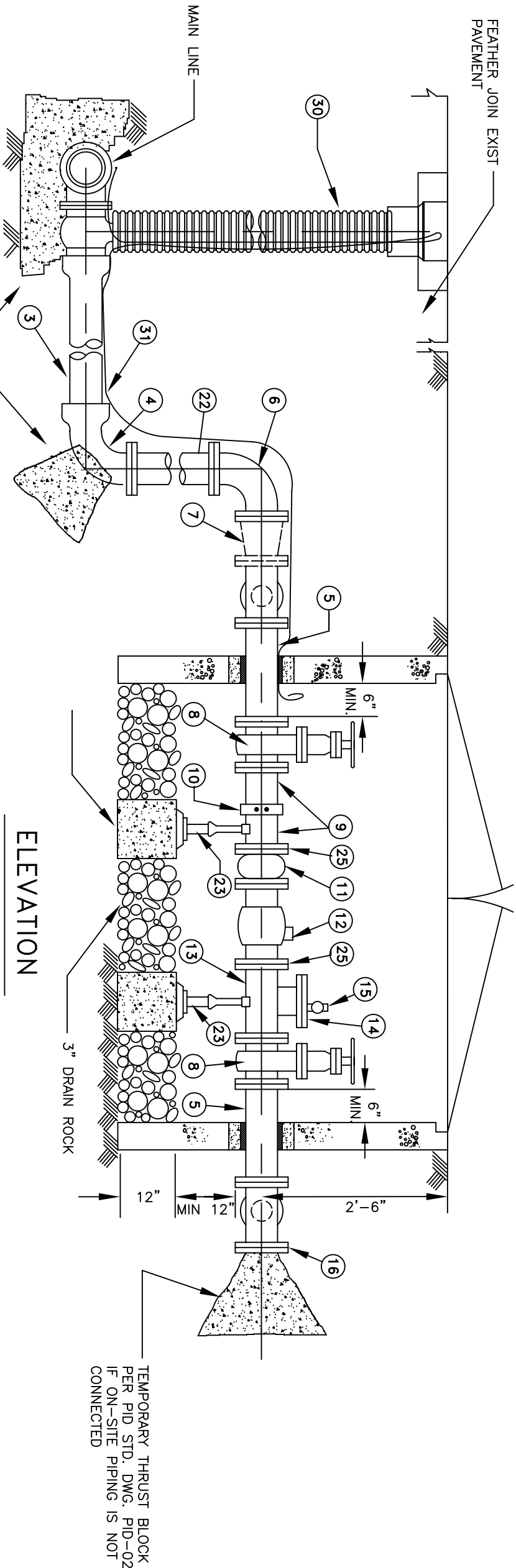
SHEET 1 OF 1

DRAWN NE CHECKED JP
DATE
DECEMBER, 1999
NO SCALE



ALTERNATE LAYOUT
LOWER 90° BEND ROTATED
90° FOR METER RUN
PARALLEL TO CURB

PLAN



ELEVATION

NOTES:

1. VAULT SHOWN IS FOR PLANTER USE ONLY. FOR TRAFFIC LOADING AND OTHER REQUIREMENTS, CONTACT DISTRICT REPRESENTATIVE.
2. VAULT COVER TO BE SET TO CONFORM TO PLANTER GRADE. SURROUNDING GROUND SHALL DRAIN AWAY FROM VAULT.

THRUST BLOCK SIZED PER
PID STD. DWG. PID-02 (TYP.)

TEMPORARY THRUST BLOCK
PER PID STD. DWG. PID-02
IF ON-SITE PIPING IS NOT
CONNECTED



PARADISE IRRIGATION DISTRICT
STANDARD DRAWING

PID-07
SHEET 1 OF 2

3" & 4" METER INSTALLATION

DRAWN
NE
DATE
JANUARY, 2001
CHECKED
JP
NO SCALE

MATERIALS

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
①	1 EACH	— SIZE X 4" TAPPING SLEEVE (USE PUSH-ON X FLG. TEE IF HOT TAP IS NOT REQUIRED).
②	1 EACH	— 4" FLG. X FLG. TAPPING VALVE (USE RW OR GATE VALVE IF HOT TAP IS NOT REQUIRED).
③	AS REQ'D	— 4" PVC PIPE OR D.I. PIPE LATERAL, PUSH-ON JOINTS
④	1 EACH	— 4" D.I. 90° ELL, PUSH-ON X FLG.
⑤	2 EACH	— FLG. x FLG. D.I. SPOOL - METER SIZE X 2'-6"
⑥	1 EACH	— 4" D.I. 90° ELL FLG. X FLG.
⑦	1 EACH	— 4" X 3" D.I. REDUCER FLG. X FLG. (FOR 3" SERVICE ONLY)
⑧	2 EACH	— RW OR GATE VALVE FLG. X FLG. W/HAND WHEEL
⑨	2 EACH	— FLG. X GROOVED END D.I. SPOOL, 6" LENGTH
⑩	1 EACH	— GROOVED-END COUPLING
⑪	1 EACH	— STRAINER
⑫	1 EACH	— 3" OR 4" METER, SUPPLIED BY DISTRICT
⑬	1 EACH	— METER SIZE X 6" D.I. TEE - FLANGED
⑭	1 EACH	— METER-SIZE D.I. COMPANION FLANGE TAPPED FOR 2" I.P.
⑮	1 EACH	— 2" CORPORATION STOP - M.I.P. X M.I.P.
⑯	1 EACH	— D.I. BLIND FLANGE
⑰	2 EACH	— METER SIZE FLANGED D.I. TEE
⑱	6 EACH	— ADAPTER - 2" M.I.P. BY S.J.
⑲	AS REQ'D	— 2" COPPER TUBING
⑳	2 EACH	— 2" 90° ELBOW - S.J. X S.J.
㉑	1 EACH	— 2" BALL VALVE WITH LOCKING WING - F.I.P. X F.I.P.
㉒	1 EACH	— 4" D.I. SPOOL - FLG. X FLG. (IF REQUIRED)
㉓	2 EACH	— ADJUSTABLE GALV. PIPE SUPPORT.
㉔	1 EACH	— PRECAST CONCRETE VAULT (5'-0" WIDE X 6'-6" LONG X 5'-0" HIGH) WITH SPRING ASSIST HINGED DIAMOND PLATE ALUMINUM COVER AND RECESSED LOCKING HASP. PROVIDE 6" X 12" HINGED READING LID INSTALLED OVER METER REGISTER.
㉕	4 EACH	— BOLT AND FLANGE INSULATING KIT
㉖	1 EACH	— GALV. STEEL LADDER (ALHAMBRA FOUNDRY A3400) W/LADDER - UP AND S.S. ANCHOR BOLTS.
㉗	2 EACH	— METER SIZE BRONZE COMPANION FLANGE WITH 2" THREADED I.P. OUTLET
㉘	2 EACH	— 2" ELLIPTICAL METER FLANGE (SPACING AS REQUIRED FOR 2" BYPASS METER)
㉙	2 EACH	— 2" PIPE SUPPORT
㉚	AS REQ'D	— CORRUGATED PLASTIC CAN STOCK
㉛	AS REQ'D	— NO. 12 AWG SOLID COPPER WIRE W/TYPE UF INSULATION



PARADISE IRRIGATION DISTRICT STANDARD DRAWING

3" & 4" METER INSTALLATION

PID-07

SHEET 2 OF 2

DRAWN CHECKED
NE JP

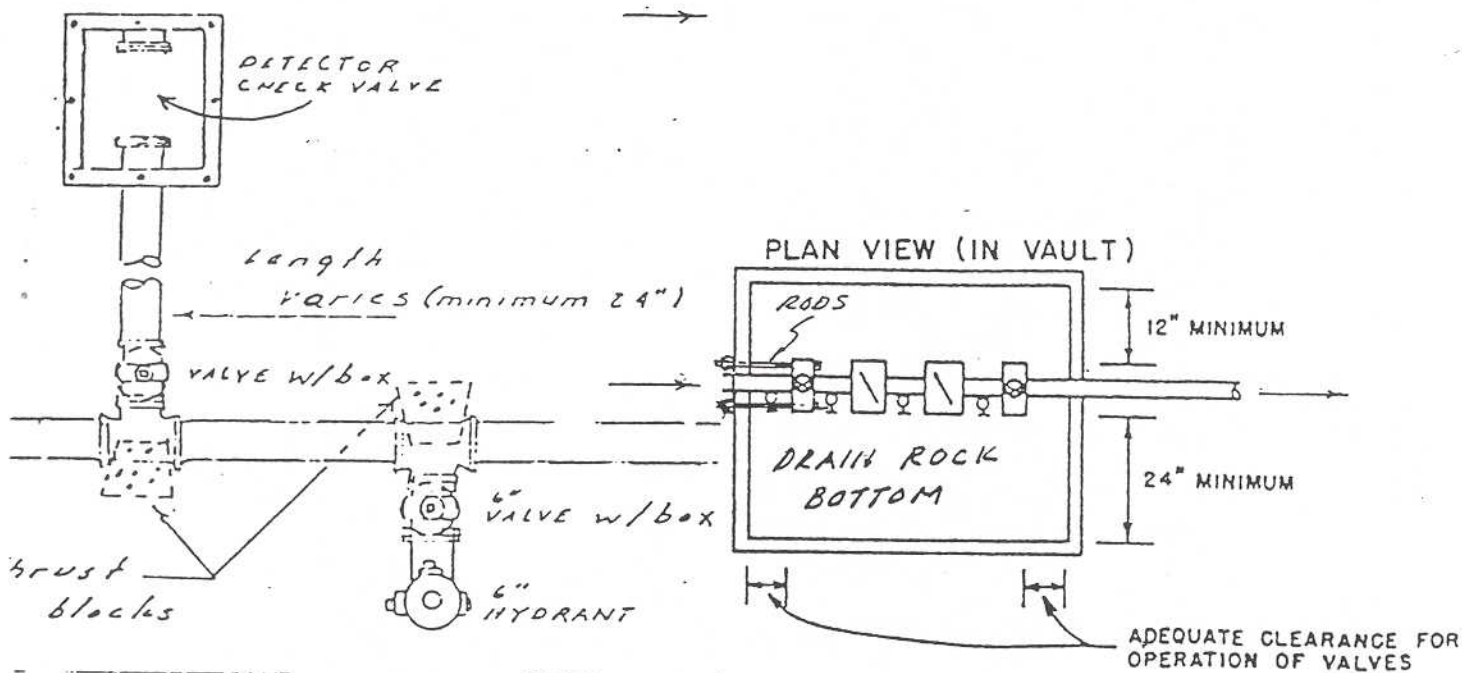
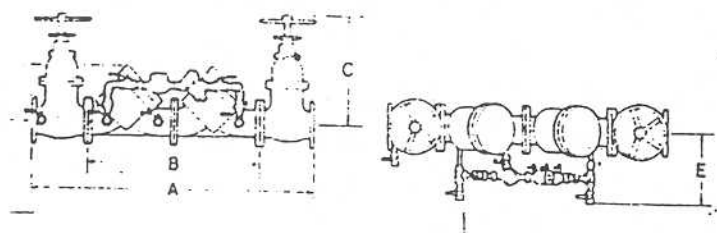
DATE
JANUARY, 2001

NO SCALE

DOUBLE CHECK DETECTOR ASSEMBLY 4" through 10"

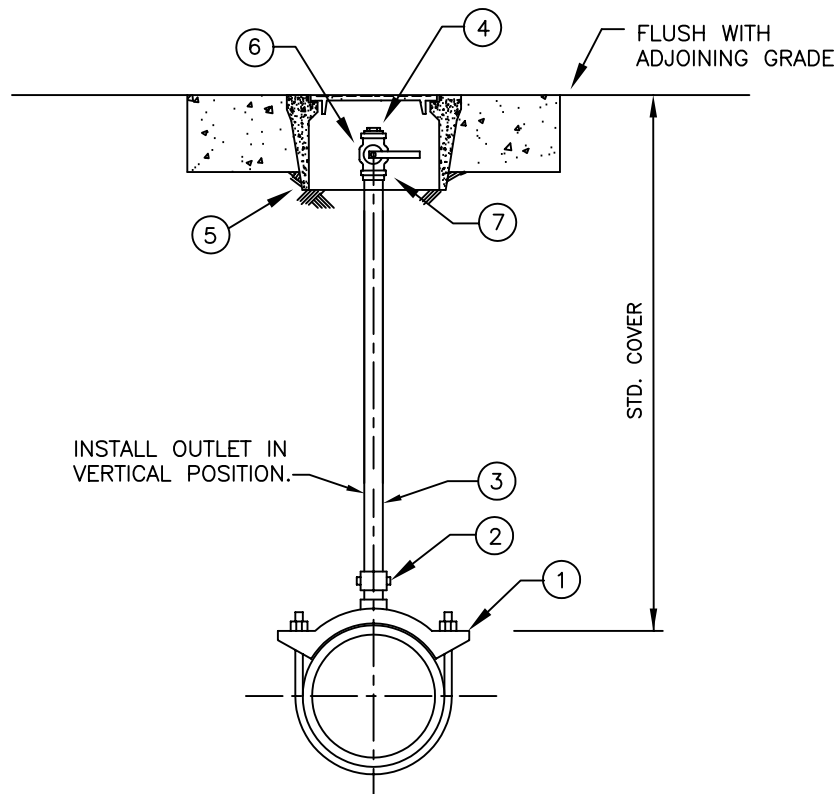
Dimensions and Weights

SIZE	A	B	C	D	E	NET WT (LBS.)	NET WT. (LG.)
4"	50 $\frac{1}{16}$ "	32 $\frac{1}{16}$ "	23 $\frac{1}{4}$ "	11"	15"	499	196.3
6"	55 $\frac{1}{16}$ "	38 $\frac{1}{16}$ "	32 $\frac{3}{16}$ "	14"	16"	812	308.3
8"	69 $\frac{1}{16}$ "	46 $\frac{1}{16}$ "	41 $\frac{1}{4}$ "	18"	17"	1307	492.9
10"	84 $\frac{3}{16}$ "	58 $\frac{1}{16}$ "	50 $\frac{1}{2}$ "	22"	20"	1767	651.5



BACK FLOW PROTECTION-FIRE SYSTEMS

PARADISE IRRIGATION DISTRICT-STANDARD 08



ITEM
NO

MATERIALS

- ① DOUBLE S.S. STRAP DUCTILE IRON
SERVICE SADDLE W/ I.P. OUTLET
- ② BRONZE CORPORATION STOP, M.I.P.
THREAD X COMPRESSION OR FLARE
- ③ TYPE "K" SOFT COPPER TUBING
- ④ BRASS M.I.P. PLUG
- ⑤ CONCRETE VALVE BOX W/ CAST
IRON LID, SET IN CONCRETE COLLAR
- ⑥ BRASS FULL PORT BALL VALVE
(W/ S.S. BALL) WATTS OR EQUAL
- ⑦ ADAPTER, M.I.P. X FLARE OR COMPRESSION



PARADISE IRRIGATION DISTRICT STANDARD DRAWING

MANUAL AIR VALVE ASSEMBLY

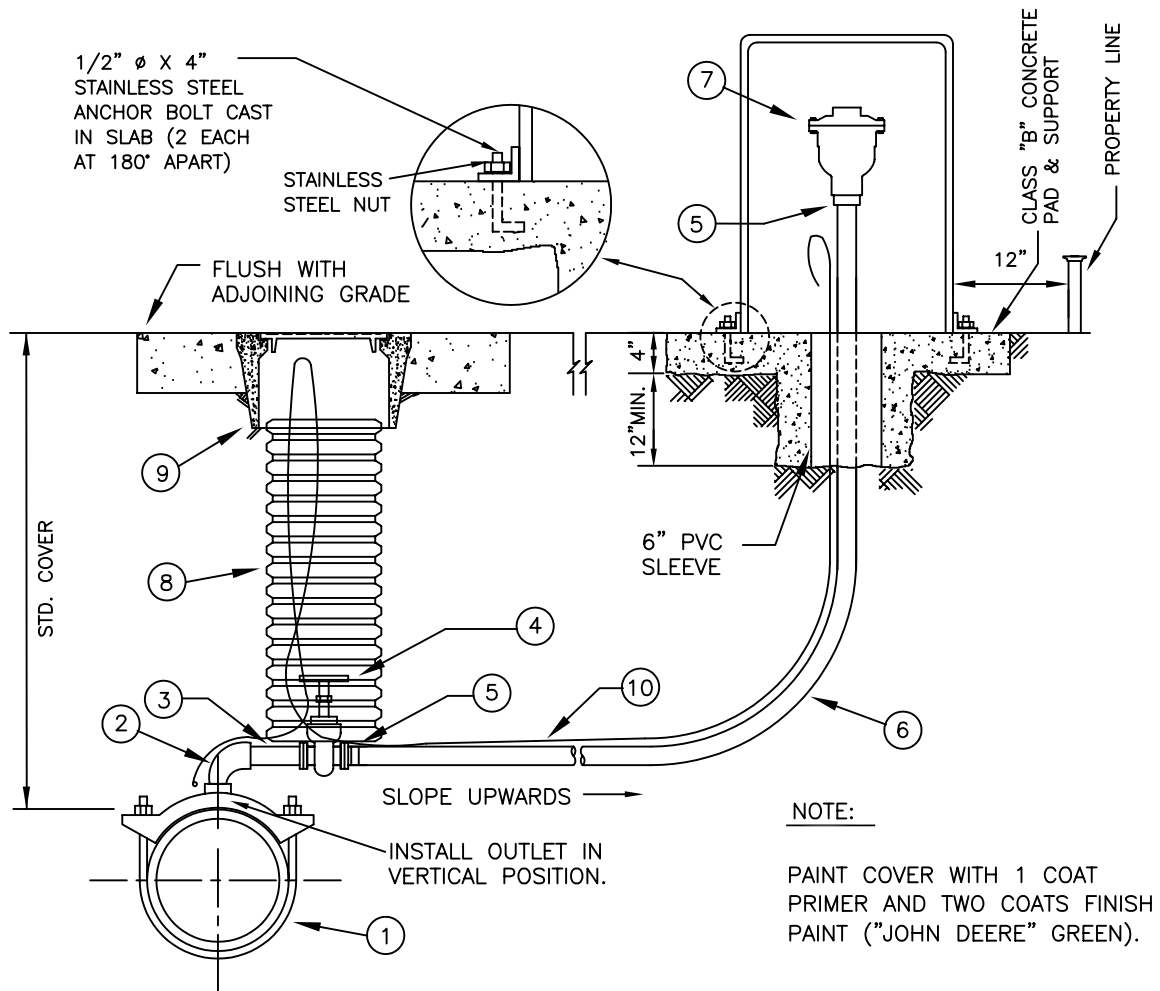
PID-09

SHEET 1 OF 1

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DATE
DECEMBER, 1999

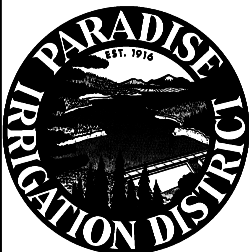
NO SCALE



ITEM
NO

MATERIALS

- ① DOUBLE S.S. STRAP DUCTILE IRON SERVICE SADDLE W/ I.P. OUTLET
- ② BRASS OR BRONZE STREET ELBOW
- ③ BRASS OR BRONZE NIPPLE
- ④ BRONZE GATE VALVE
- ⑤ ADAPTER, M.I.P. THREAD X FLARE OR COMPRESSION
- ⑥ TYPE "K" SOFT COPPER TUBING
- ⑦ AIR AND VACUUM VALVE, CRISPIN SERIES AL
- ⑧ CORRUGATED PLASTIC CAN STOCK
- ⑨ CONCRETE VALVE BOX W/ CAST IRON LID, SET IN CONCRETE COLLAR
- ⑩ NO. 12 AWG SOLID COPPER WIRE W/TYPE UF INSULATION



PARADISE IRRIGATION DISTRICT STANDARD DRAWING

AIR RELEASE & VACUUM RELIEF VALVE ASSEMBLY

PID-10

SHEET 1 OF 1

DRAWN NE CHECKED JP

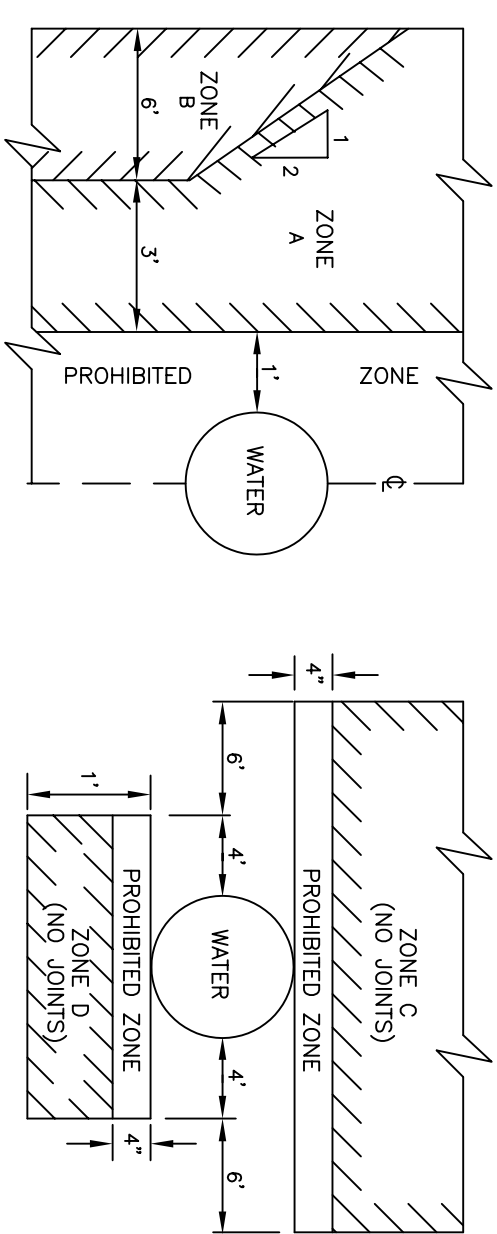
DATE
DECEMBER, 1999

NO SCALE

BASIC SEPARATION STANDARDS

- 1. PARALLEL CONSTRUCTION: THE HORIZONTAL DISTANCE BETWEEN PRESSURE POTABLE WATER MAINS AND SEWER LINES SHALL BE AT LEAST 10 FEET.
- 2. PERPENDICULAR CONSTRUCTION (CROSSING): PRESSURE WATER MAINS SHALL BE AT LEAST ONE FOOT ABOVE SANITARY SEWER LINES WHERE THESE LINES MUST CROSS.
- 3. SPECIAL PROVISIONS: ALTERNATIVE CONSTRUCTION CRITERIA WHERE THE BASIC SEPARATION STANDARDS CANNOT BE ATTAINED ARE SHOWN BELOW:

SITUATION: LOCATION OF NEW SEWER LINES TO EXISTING WATER LINES



PARALLEL CONSTRUCTION

PERPENDICULAR CROSSING

IF ANY SEWER PIPELINES ARE TO BE CONSTRUCTED WITHIN ANY OF THE ABOVE INDICATED ZONES, SPECIAL CONSTRUCTION SHALL BE REQUIRED AS DESCRIBED BELOW.

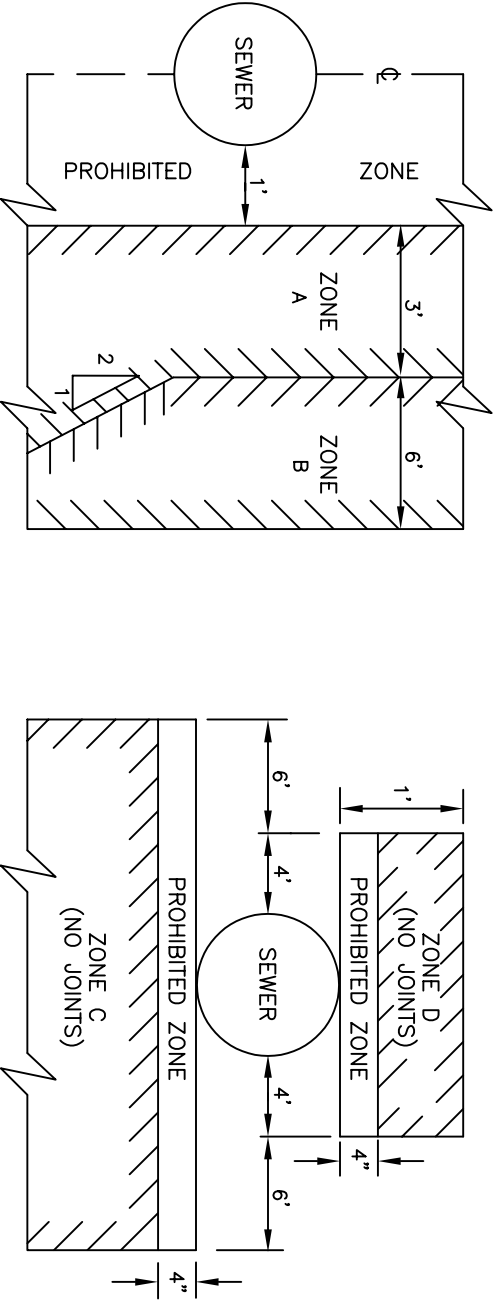
ZONE SEWER

- A DO NOT LOCATE ANY PARALLEL SEWER LINES IN THIS AREA WITHOUT STATE AND LOCAL HEALTH DEPARTMENT APPROVAL.
- B USE VCP OR DIP WITH COMPRESSION JOINTS
- C USE DIP WITH MECHANICAL JOINTS OR CLASS 200 PVC – AWWA C900
- D USE DIP OR CLASS 200 PVC – AWWA C900

GENERAL NOTES

- 1. NO PIPE JOINTS SHALL BE PERMITTED WITHIN ZONE D. IT IS THE INTENT OF THESE SPECIFICATIONS THAT NO JOINTS SHALL OCCUR WITHIN ZONE C. IF THAT CANNOT BE ACCOMPLISHED, THE NEW PIPELINE SHALL BE ENCASED IN CONCRETE FOR THE FULL LENGTH OF ZONE C. ENCASEMENT SHALL BE PER STD. DWG. PID-11, TYPE 'B'.
- 2. ALL D.I.P. MUST HAVE HOT DIP BITUMINOUS COATING AND ALL CLASS 200 PVC MUST MEET DR-14 PER AWWA C900 OR EQUIVALENT.
- 3. SEWER FORCE MAINS SHALL NOT BE PERMITTED IN ZONES A THROUGH D.
- 4. WHERE CROSSINGS ARE NOT PERPENDICULAR, HORIZONTAL SPACING REQUIREMENTS SHALL BE MEASURED ALONG A LINE PERPENDICULAR TO THE WATER MAIN.
- 5. THE CONSTRUCTION CRITERIA APPLY TO HOUSE LATERALS THAT CROSS ABOVE A PRESSURE WATER MAIN BUT NOT TO THOSE HOUSE LATERALS THAT CROSS BELOW A PRESSURE WATER MAIN.

SITUATION: LOCATION OF NEW WATER LINES TO EXISTING SEWER LINES



PARALLEL CONSTRUCTION

PERPENDICULAR CROSSING

IF ANY WATER PIPELINES ARE TO BE CONSTRUCTED WITHIN ANY OF THE ABOVE INDICATED ZONES, SPECIAL CONSTRUCTION SHALL BE REQUIRED AS DESCRIBED BELOW.

ZONE POTABLE WATER

- A DO NOT LOCATE ANY PARALLEL DOMESTIC WATER MAIN IN THIS AREA WITHOUT STATE AND LOCAL HEALTH DEPARTMENT APPROVAL.
- B USE DIP OR CLASS 200 PVC – AWWA C900
- C USE DIP OR CLASS 200 PVC – AWWA C900
- D USE DIP OR CLASS 200 PVC – AWWA C900



PARADISE IRRIGATION DISTRICT
STANDARD DRAWING

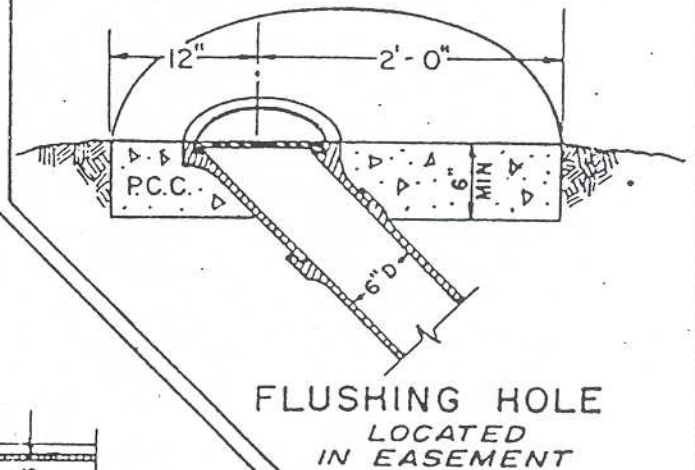
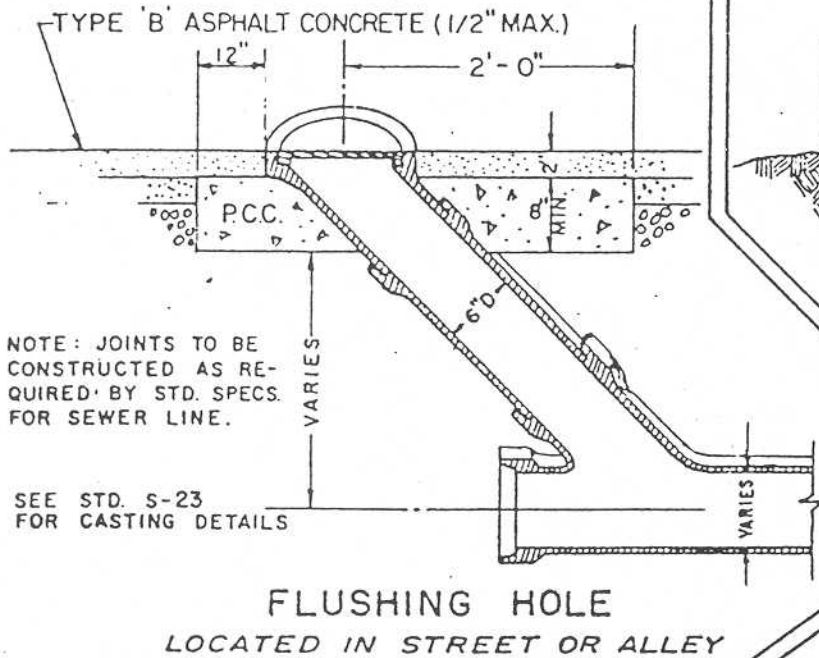
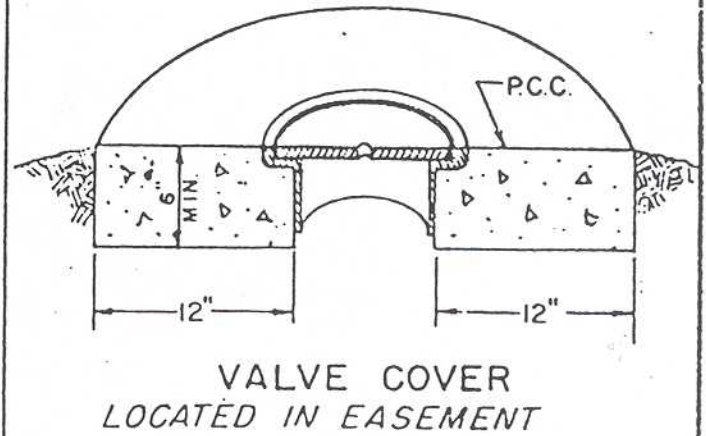
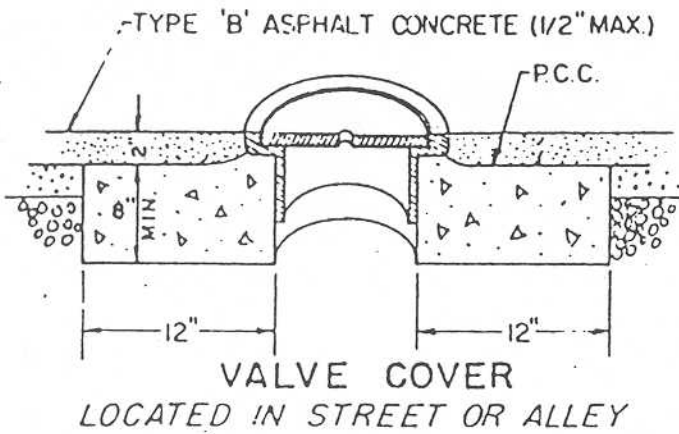
STATE HEALTH DEPT. EXCEPTIONS TO BASIC
SEPARATION STANDARDS FOR
POTABLE WATER AND SEWER PIPELINES

PID-11

SHEET 1 OF 1

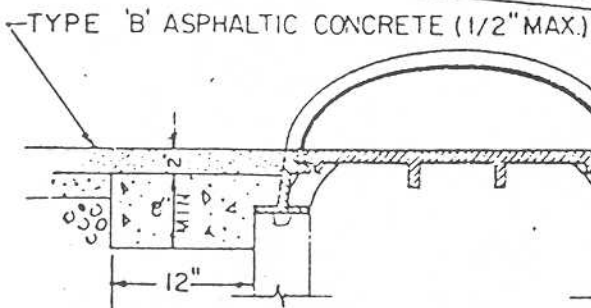
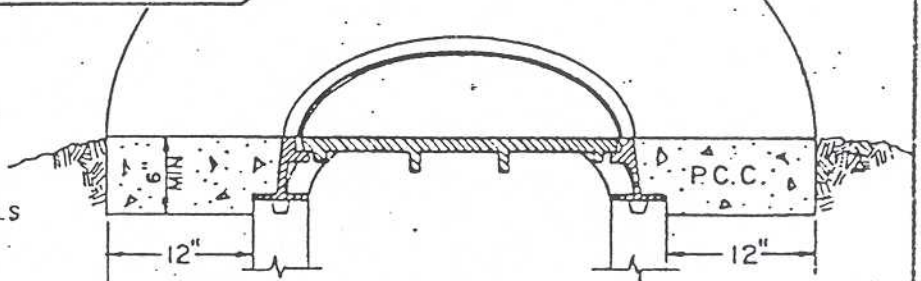
DRAWN
NE
DATE
DECEMBER, 1999

CHECKED
JP
NO SCALE



MANHOLE FRAME & COVER LOCATED IN EASEMENT

SEE STD. S-24 FOR CASTING DETAILS



COUNTY OF BUTTE

DEPARTMENT OF PUBLIC WORKS

TITLE
TYPICAL METHOD FOR
SETTING APPURTENANCES

STANDARD NO.

S-22

SCALE : NONE

Appendix 4. Certification Statement

CERTIFICATION STATEMENT

PROPOSITION 13 URBAN WATER CONSERVATION CAPITAL OUTLAY GRANT

I hereby certify that the Water Main Replacement project proposed in this application complies with the requirements of the Consolidated Water Use Efficiency 2002 Proposal Solicitation Package dated January 4, 2002. I further certify that the project is feasible from an engineering, construction and economic viewpoint.

Certified by:



Ray A. Auerbach

California Registered Civil Engineer No. 20236



Appendix 5. Resumes

RESUME

RAY A. AUERBACH

EXPERIENCE SUMMARY

Ray Auerbach is the Manager of the Paradise Irrigation District and has 35 years experience in water resources finance, administration, engineering, operations and intergovernmental relations. Mr. Auerbach has a strong background in engineering and project management for various types of projects, including pipeline replacement.

DETAILED EXPERIENCE

Paradise Irrigation District

- Manager of the Paradise Irrigation District from June 1998 to present. Under policy direction of a five-member elected Board of Director is responsible for all District functions including engineering, finance, operations and maintenance and intergovernmental and public relations.
- Secured a \$493,000 grant from the Department of Water Resources to investigate the feasibility of additional water supply options.
- Managed and participated in the preparation of the 2000 Urban Water Management Plan.
- Revised financial and management reports submitted to the Board of Directors.
- Participated in Drafting the Memorandum of Understanding between the District, the Butte County Department of Water and Resource Conservation and the Del Oro Water Company.

Raymond C. Miller, P.E. and Roberson and Associates

- Associated with Raymond C. Miller and Don Roberson from June 1997 to June 1998.
- Provided contract management services to the City of San Juan Capistrano and the Tri-Cities Municipal Water District.

Capistrano Valley Water District

- General Manager from July 1987 to June 1997. Assistant General Manager/District Engineer from January 1986 to June 1987.
- Reduced unaccounted for water from over 10% to 5%
- Established a replacement program to replace the District's aging infrastructure.
- Secured additional water capacity in a new regional water supply pipeline.

City of Anaheim Public Utilities Department

- Served in several positions between December 1968 and December 1985, including nine years as Water Engineering Manager.
- Responsible for budgeting, planning, engineering and contract engineering for Orange County's largest retail water agency.

Los Angeles County Flood Control District

- Civil Engineering Assistant and Senior Civil Engineering Assistant from July 1966 to November 1968.

Irvine Ranch Water District Board of Directors

- Member of Board of Directors from December 1979 to June 1998.

PROFESSIONAL AFFILIATIONS

- American Water Works Association
- American Society of Civil Engineers

PROFESSIONAL REGISTRATION

- Registered Civil Engineer in California, No. 20236

EDUCATION

- East Los Angeles College – Associate of Arts Degree, 1964
- California State University at Los Angeles – Bachelor of Science Degree, Civil Engineering, 1966
- Numerous training sessions and seminars in supervision, management, public relations, etc.

RESUME

NEIL ESSILA

EXPERIENCE

Paradise Irrigation District

12/98-Present

Assistant Engineer. Performed analysis and design activities for various types of projects. Researched and acquired rights of way. Performed distribution system hydraulic model development and application. Revised District pipeline standard drawings and specifications. Reviewed project proposals and drafted conditions and agreements. Performed plan checking and construction inspection on developer projects. Initiated District use of AutoCAD and conversion of hand-drawn system maps to CAD mapping.

University of Minnesota, Minneapolis, Minnesota

11/97-2/98

Research Fellow –Developed a computer model to allow the extension of theoretical membrane-supported biofilm model studies at the microscopic scale to medium scale wastewater treatment facilities. Collaborated on experimental program development.

RCM Associates, Minnetonka, Minnesota

4/95-9/96

Project Engineer – Water Resources Department. Performed water system studies including computerized hydraulic analysis of distribution systems, and assessments of system sources, treatment, and storage. Drafted water utility Emergency Preparedness and Conservation Plans. Designed municipal wells, including collection of hydrogeologic data and study of hydrologic effect of water withdrawals from a politically sensitive, protected aquifer. Completed hydraulic and hydrologic analyses for storm water management.

Barr Engineering Company, Minneapolis, Minnesota

6/93-9/94

Civil Engineering Intern – Performed a wide range of technical duties including analysis, computation, drafting, writing, and fieldwork. Assisted in preparation of plans, specifications, and engineers' cost estimate for water treatment plant expansion. Also carried out hydraulic analyses, checked design computations, and sized some system components for this project.

PROFESSIONAL REGISTRATION: Engineer in Training

PROFESSIONAL ASSOCIATIONS:

American Water Works Association
American Society of Civil Engineers

EDUCATION:

Master of Science in Civil Engineering with environmental emphasis. University of Minnesota, 1997.

Bachelor of Civil Engineering *Magna Cum Laude*, with environmental emphasis in water treatment. Institute of Technology, University of Minnesota, 1994.

RESUME

JOHN H. PRICE

EXPERIENCE SUMMARY

John Price is the Field Superintendent for the Paradise Irrigation District and has 30 years experience in construction and construction management. Mr. Price has considerable experience in underground construction with an emphasis on water main, fire hydrant and other water system component installation and maintenance.

DETAILED EXPERIENCE

Paradise Irrigation District

- **Superintendent** of the Paradise Irrigation District, with nine years of experience. Responsible for the day-to-day operations of the District's water distribution system consisting of approximately 170 miles of pipeline and nearly 10,000 water meter services.
- Supervise a 20-person crew engaged in system operation, maintenance and construction, facility upkeep, fleet vehicle maintenance, meter reading, etc.
- Develop and oversee the District's Capital Improvement program for pipeline replacement averaging about 9,000 feet of pipe replacement yearly.
- Develop and maintain records documenting systems repairs to include water main leaks, service pipe leaks and fire hydrant installation and repair and the District's leak detection program.
- **Utility Foreman** of the Paradise Irrigation District with eight years of experience. Responsible for installing and maintaining the District's water pipe system.
- **Equipment Operator** for the Paradise Irrigation District with five years' experience. Operated heavy equipment during the installation and maintenance of the District's water distribution system.

City of Santa Cruz

- **Construction Specialist** for the City of Santa Cruz Street Department with seven years' experience. Operated equipment and supervised crews during the construction and maintenance of City streets and drainage systems. Built roads, curbs, gutters, sidewalks, and installed storm drain systems and piping.

Education

- Associate of Arts Degree in Drafting Technology.
- U.S. Army Signal School, Fort Monmouth, New Jersey, Fixed Plant Carrier Equipment Repair School.

Appendix 6. Letters of Support



Fire Department



February 27, 2002

California Department of Water Resources
Office of Water Use Efficiency
PO Box 942836
Sacramento, CA 94236-0001

Attn: Marsha Prillwitz

Subject: Support for Paradise Irrigation District's Prop 13 Grant Request

The Town of Paradise Fire Department works closely with the Paradise Irrigation District, (PID) to ensure that our community has a reliable and safe water delivery system.

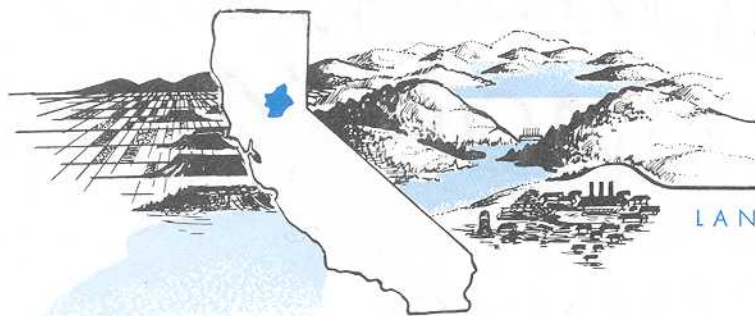
Because of the extreme threat from wildland fire in the community, it is important that an adequate fire flow is available throughout the entire area. This has been hampered by older 4' mains that offer a substandard fire flow and often become the source of leaks.

The Town and the PID are working together to replace these mains but are many years away from completing this project. Any funding that would address this issue would result in a more reliable water system that would greatly improve the safety of our community.

If you have any questions feel free to call me at (530) 872-6266.

Sincerely,

Jim Broshears
Fire Chief



Butte County

LAND OF NATURAL WEALTH AND BEAUTY

WATER AND RESOURCE CONSERVATION

2279 DEL ORO AVENUE, SUITE A • OROVILLE, CALIFORNIA 95965-3396
(530) 538-4343 • FAX: (530) 538-3807 • bcwater@buttecounty.net

February 26, 2002

ED CRADDOCK
Director

California Department of Water Resources
Office of Water Use Efficiency
P.O. Box 942836
Sacramento, CA 94236-0001
Attention: Marsha Prillwitz

RECEIVED

FEB 26 2002

PARADISE IRRIGATION
DIST

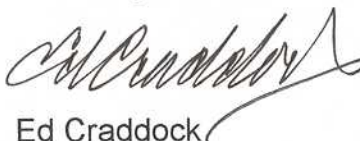
Dear ^{Marsha} Ms. Prillwitz

I'm writing to support the application for a Proposition 13 Urban Water Conservation Capital Outlay Grant for Paradise Irrigation District (PID). Butte County's Water Inventory and Analysis, funded under Proposition 204, has shown that the Paradise Ridge can face water supply shortages during one severe drought year similar to 1977. The need for additional water supplies on the Paradise Ridge led to the execution of a Memorandum of Understanding (MOU) between the County, Del Oro Water Company and PID in January 2001. The MOU helps ensure collaborative efforts in creating water supplies through efficient water management.

In my many years with the Department of Water Resources, it became apparent that leak detection and repair was one of the most cost-effective urban water management practices. PID's efforts toward reducing losses in their system have been successful over the past two decades, and upgrading their program is important to reduce their "unaccounted for water" further. By improving their program, PID should be able to reduce their system losses substantially during this decade nearer to the statewide average.

It is critically important that citizens in area of origin counties are protected from water shortages, while millions of acre-feet are being stored for use elsewhere in California.

Sincerely


Ed Craddock



Kim K. Yamaguchi

Supervisor, Fifth District

747 Elliott Road
Paradise, Ca 95969

Phone: (530) 872-6304 Fax: (530) 872-6339
E-Mail: KYamaguchi@ButteCounty.net

February 28, 2002

California Department of Water Resources
Office of Water Use Efficiency
P.O. Box 942836
Sacramento, CA. 94236-0001
Attention: Marsha Prillwitz

Subject: Support for Paradise Irrigation District Grant Application

Dear Members,

I would like to support the Paradise Irrigation District's grant application under Proposition 13 Water Use Efficiency Grant Program. The District has been working hard to replace and repair the existing water delivery system and has made strident gains to date. The old antiquated system had numerous leaks and weak points that had long been neglected. The P.I.D. implemented an ambitious repair and replace plan that has shown much success. However, the District still needs an aggressive replacement program to continue the success, and is in much need of additional funds to keep the beneficial progress continuing in our community.

I, along with the Butte County Water and Resource Department, and P.I.D. have been working together to find additional sources of water, and programs of water conservation to benefit the 5th District. Although some of the solutions to our water shortage are possible to implement, they are costly and years away from implementation. The main replacement program has had a major impact in curing the water loss through leaks. We, the community of 27,000 citizens, have only 12,500 acre feet of water storage capacity, and any loss of water represents a significant impact.

Please help our community and its citizens by granting us the ability to help ourselves better manage the precious natural resource of water. Thank you and God Bless America.

Sincerely,

A handwritten signature in dark ink, appearing to read "Kim K. Yamaguchi", is written over the word "Sincerely,".

Kim K. Yamaguchi,
Butte County Supervisor
District 5